FISH AND HABITAT SURVEY: WHITEFISH LAKE TRIBUTARIES

June to October 2009

PREPARED FOR

SWAN VALLEY SPORTFISHING ENHANCEMENT CORPORATION

PREPARED BY

M. Lowdon
AAE Tech Services Inc.
119 Woodchester Bay
Winnipeg, MB R3R 3E5

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1.0 INTRODUCTION

Whitefish Lake is one of the most popular recreational fishing destination sites, and potentially one of the most heavily fished lakes, within the Swan Lake Watershed. Due to its close proximity to Swan River, many avid fishermen make their way to the lake after work to catch their daily limits. The Swan Valley Sport Fishing Enhancement Corporation (SVSFE) has also been actively involved in enhancing fishing opportunities on Whitefish Lake by constructing a permanent walkway and boat launch. An annual fishing derby, sponsored by the Lions Club, is also held on Whitefish Lake during mid March. At this event there are approximately 400 participants enjoying, not only excellent fishing opportunities, but the chance to raise funds for conservation efforts.

As Whitefish Lake gains in popularity, there is however, an increased need to help protect the fish populations within the lake. Cottage development, an expanding campground, and a growing angling community all contribute to increased pressure on the Whitefish Lake fish communities. In addition, the loss of valuable spawning habitat within the two tributaries flowing into Whitefish Lake (North Creek and Lagoon Creek), as a result of extensive beaver activity, is most likely increasing the stress upon the fish populations within Whitefish Lake. Tributaries in general are ideal locations for spawning as they provide; warm water that accelerate the growth of fish eggs, increasing their chance of survival; flowing water rich in dissolved oxygen, important for egg development; and each tributary is equipped with the necessary substrate types (rock and gravel) needed for eggs adhesion during the spawning process. All of these attributes promote the need to preserve the spawning habitats within each tributary around the lake, to help maintain natural and healthy fish populations. Furthermore, a telemetry study was conducted on Whitefish Lake in 2005. Eight Walleye were captured, tagged, and released. During the spring spawning run all Walleye were observed near the outlets of the Whitefish Lake tributaries (4 – North Creek, 4 – Lagoon Creek). These results verify the importance these tributaries provide to the Walleye community during their spawning run. Rehabilitation efforts are encouraged to help improve and protect the spawning habitat around the lake, within these tributaries, to benefit the Whitefish Lake fish community.

The Swan Valley Sport Fishing Enhancement group initiated this project to start the rehabilitation process. The project objectives were: 1) to conduct detailed habitat assessments on each Whitefish Lake tributary (North Creek and Lagoon Creek) to better understand and document the potential and/or available spawning habitat within each creek; 2) to conduct fish community surveys to better understand species utilization, species composition, and relative abundance of fish within both tributaries during the summer and fall of 2009; 3) to identify barriers impeding fish movement; and 4) to provide a number of recommendations on how to improve and restore the habitat within the selected tributaries. Results of this study will provide and list future enhancement initiatives needed to improve the quality of spawning habitat within each tributary.

1.1 SITE DESCRIPTION

Whitefish Lake is located in the southwest corner of the Porcupine Provincial Forest approximately 40 kilometers northwest of Swan River (Figure 1). The Lake is approximately 675 hectares in size. Average water depths range around 30 feet, however there are a couple deeper pockets with depths approaching 64 feet (Figure 2). Rock, sand, and gravel are the dominant substrate types aligning the shoreline. The deeper sections are dominated by mud, soft mud and clay (Figure 2). There are two main tributaries draining the Whitefish Lake Watershed. North Creek is approximately 15.8 km long and is located on the north shore. The drainage area of North Creek is approximately 52 km^2. Lagoon Creek, located on the east shore, is approximately 9.0 km in length with a drainage area of 38 km^2. Lagoon Creek is unique, as the mouth of the creek has been developed into a marina and boat launch for recreational fishing use. For the purpose of this study, the habitat assessed within Lagoon Creek is documented upstream of the marina where the creek narrows. Habitat characteristics of each creek will be described in detail throughout this report.

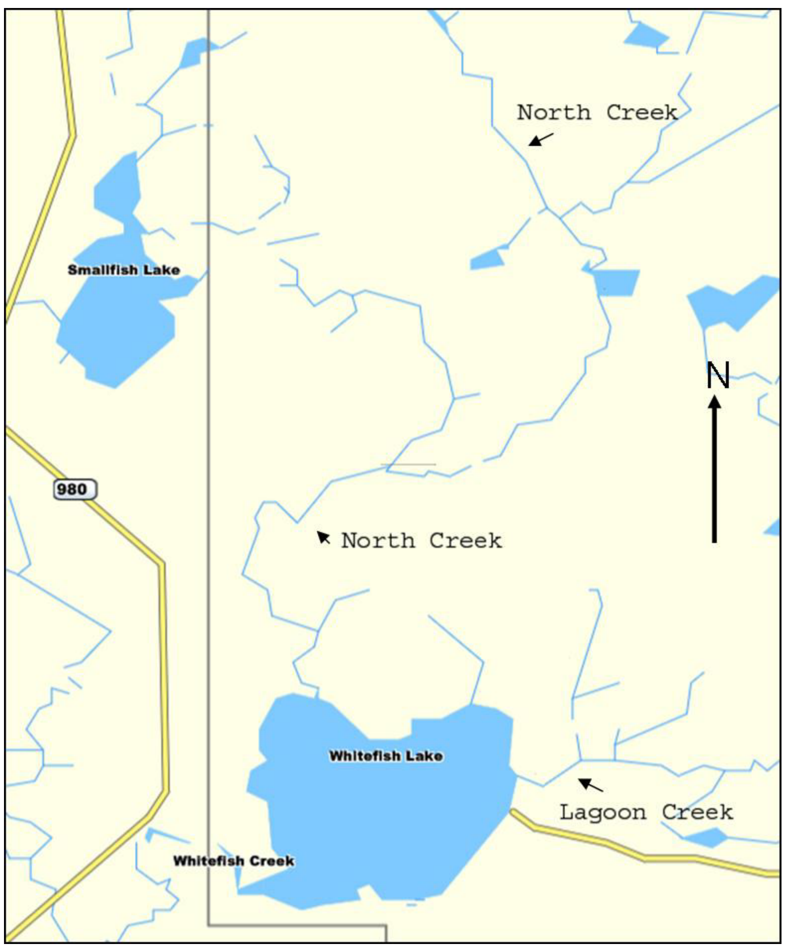


Figure 1. Map of Whitefish Lake showing the location of the two tributaries, North Creek and Lagoon Creek examined during this study

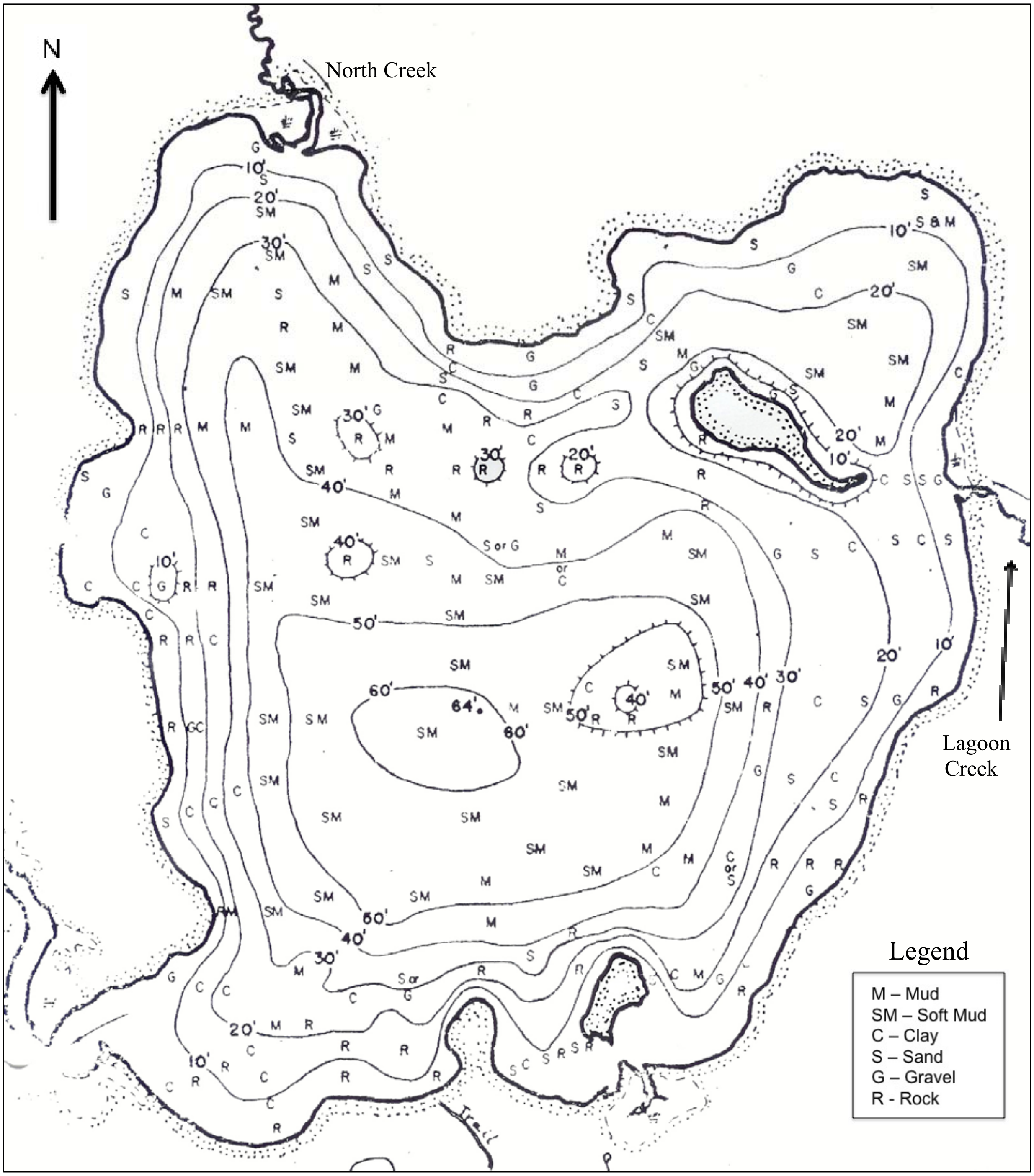


Figure 2. Bathymetry map illustrating depth contours and substrate types within Whitefish Lake. Diagram provided by Ian Kitch, Provincial Fisheries Biologist.

1.2 STUDY DESIGN

The Swan Valley Sport Fishing Enhancement Corporation, with the assistance from Manitoba Fisheries Enhancement Fund (FEF), contracted AAE Tech Services Inc. to conduct a detailed fish and habitat survey on two Whitefish Lake tributaries, North Creek and Lagoon Creek. The main goal of the project was to document fish utilization and define the fish habitat currently found within each creek during the summer and fall of 2009. An additional goal of the project was to develop a management strategy with future guidelines to improve the spawning habitat currently found within the tributaries, to ultimately benefit the recreational fishery on Whitefish Lake. Specific objectives of the project were to:

- Document fish habitat within both Whitefish Lake tributaries;
- Document slope and channel bed characteristics of each tributary;
- Record daily flows and continuous water temperature;
- Provide a photo record and GPS locations of quality walleye spawning habitat within each creek;
- Identify potential negative impacts to walleye spawning;
- Document barriers potentially impeding fish movement;
- Document fish utilizing North Creek and Lagoon Creek during the summer and fall of 2009.
- Attend meetings with the SVSFE group to discuss results of the project; and
- Provide a summary of the results in a technical report to the SVSFE group.

This report summarizes the results of the fish and habitat survey on the Whitefish Lake tributaries in 2009 and provides recommendations to improve the quality of fish habitat within each tributary. Attached to this report is a cd with an electronic copy of the report as well as all digital photographs taken during both aerial and ground truthing surveys. This report also provides supporting documentation for future FEF or other funding applications to carry out the recommended enhancement initiatives.

2.0 APPROACH AND METHODOLOGY

2.1 FISH HABITAT ASSESSMENT

A fish habitat inventory was conducted, identifying and classifying the habitat types found within Whitefish Lake tributaries, Lagoon Creek and North Creek. Habitat characteristics, such as run/riffle/pool sequences as well as substrate type, cover, and channel dimensions were documented. Location and description of potential barriers to fish movement were recorded. In order to document the habitat found within each creek, aerial and ground truthing surveys were conducted

2.1.1 AERIAL SURVEYS

On July 9th and Sept 19th 2009, a small lightweight fixed-winged aircraft was used to assist in capturing digital images of the two tributaries flowing into Whitefish Lake, North Creek and Lagoon Creek. Dr. Andy Maxwell, a member of the SVSFE group, volunteered his time and airplane to assist with the project. A digital SLR 30-D Canon camera was used to take still images. A Garmin 60CSx GPS unit was used to document the flight path by recording waypoints (latitude and longitude coordinates) at one-second intervals during flight. The photographs were then post-processed using a software program (GPS Photolink - standard edition) designed to match the origin of each photo to the specific location each photo was taken by linking the time-stamp produced by each device. The program also created files compatible with MapSource and ArcView software mapping programs allowing one to display the flight path and linked photographs. Upon completion of the aerial surveys, identified potential barriers to fish movement were then subject to additional ground truthing surveys.

The main objectives of the aerial surveys were to:

- Provide digital still images of the riparian zone and fish habitat found along the corridors of each tributary to assist with fish habitat classification;
- Identify potential Walleye spawning locations; and
- Identify and document potential barriers impeding fish movement.

2.1.2 GROUND TRUTHING SURVEYS

Ground surveys were conducted at numerous sampling locations along both Whitefish Lake tributaries. Each survey consisted of documenting the habitat type by taking still images and describing the habitat cover, vegetation, and sediment type at the selected sampling locations. Ground truthing sampling sites were however limited to the first kilometer within North Creek and the first three kilometers within Lagoon Creek.

A small Jon boat with an electric motor was used to reach sampling sites on Lagoon Creek. Due to the large volumes of water and flooded vegetation within the creek, as a result of beaver activity, sampling by foot was unachievable. Furthermore, the amount of time needed to sample upstream habitat was limited as sampling each day began at Whitefish Lake and the furthest downstream section of the creek, not to mention the only access point.

Although sampling on North Creek was difficult, as flooded sections, large beaver runs, and heavily vegetated sections were common, it was possible to reach upstream habitat via foot. A boat was however needed get across the lake to sample the lower sections of the tributary. A trail intersecting North Creek approximately 4.0 kilometers upstream provided the means to gain access to upstream sampling sites. A quad was used to reach these sections of the tributary.

2.1.3 LONGITUDINAL PROFILE AND TOPOGRAPHY

Longitudinal profiles were conducted over the entire length of each tributary using 1:50,000 topographical maps to better understand slope of the sampled tributaries. In addition, a modified longitudinal profile was conducted on Lagoon Creek within the first 2.0 kilometers of creek (upstream from Whitefish Lake). Beaver dams (n = 28) restricting or completely blocking flow were positioned along the creek in close proximity to one another. This allowed us to document the slope of the river by measuring the difference in water level and channel bed elevation between dams. Assuming that the difference between the water level at the base of the upstream dam and the water level at the top of the downstream dam was equal to zero, our measurements will be extremely accurate. To measure the actual height of each beaver dam, and the water level and channel bed at each sampling location, a survey rod and line with a level was used. A Garmin 60CSx GPS unit was used to record the sampling locations. Distances between each dam and water level measurement were then extrapolated from the mapping software program, MapSource.

The sampling methodology describe above for Lagoon Creek was not achievable on North Creek as beaver dams positioned along the waterway were not water tight. Water levels were therefore equal on both sides of individual dams. Furthermore, using a laser level and survey rod to measure elevations was not effective as heavy vegetation along the banks restricted the distance between each measurement to a few meters.

2.1.4 CROSS-SECTIONAL PROFILES

Cross-sectional profiles were conducted within three sampling reaches of each tributary. A tape measure was extended across the channel at each cross-section. At 1.0 m intervals water depth (m) and flood plain elevation was recorded using a survey rod. A Garmin GPS unit was used to mark sampling locations. Cross-sectional profile data provides valuable information to help one better understand the hydrology and habitat conditions fish face while inhabiting these tributaries. Water velocity was not assessed for either tributary as the multiple beaver dams positioned within the creeks created “no flow” conditions.

2.1.5 WATER QUALITY

Dissolved oxygen, water temperature, conductivity, and pH were recorded daily for each sampling trip and within each tributary during the summer and fall of 2009. Turbidity was also recorded daily within each creek using a 2020e LaMotte turbidity meter. Samples were collected near the confluence with Whitefish Lake and at the furthest upstream sampling location within each creek daily.

2.1.6 WATER TEMPERATURE

Two temperature loggers (Hobo® -Water Temp Pro) were placed within North Creek and Lagoon Creek to record and monitor water temperature throughout the study. Loggers were positioned within the creeks at upstream locations and near the confluence with that of Whitefish Lake. The loggers recorded water temperature every hour for the duration of the project. All four loggers were positioned within their respected tributaries on July 10th and retrieved on September 20th, 2009.

2.2 FISH SAMPLING PROTOCOL

Fish inventories were conducted on North Creek and Lagoon Creek in the summer and fall of 2009. Various sampling methodologies were used to assess the fish community including, backpack electrofishing, minnow traps, seining, dip netting, and visual observations. Backpack electrofishing was not carried out on Lagoon Creek as the water depths far exceeded that where electrofishing could be done safely.

Backpack electrofishing (Smith-Root Model LR24) was the primary method used to assess the fish community within North Creek during the summer and fall of 2009. Electrofishing was conducted at various locations within the first 1.5 km of creek during the summer months. During the fall, sampling was conducted within one reach approximately 4.0 kilometers upstream of Whitefish Lake. Fish captured were identified, had their fork length measured, and were released live. Some voucher specimens of each species captured were preserved in 10% formalin to verify species identification. Digital photographs were also taken of representative specimens.

Seining was the most effective methodology used to capture fish within Lagoon Creek. However, due to high water levels, sampling was limited to those areas where wading was possible, or where a boat seining could be done safely. The seine net used was 10 m long (30 feet) and 1.8 m deep (6 feet), composed on nylon fabric with mesh size of 1/16 inch ace netting. To capture fish, one end of the net was held in place at a fix location. The other end of the net was swung over the sampled area as shown in the illustration below. Fish captured within the net were enumerated, identified and released unharmed. Voucher specimens for each species captured were photographed and preserved in 10% formalin. A sub-sample also had their fork lengths (FL) measured.

Five minnow traps were also placed at various locations within each tributary during the summer of 2009. Each trap was baited with bread to entice fish into the traps. The traps were set for approximately 24 hours, lifted, and then re-set for an additional 24-hour period at another sampling location. The traps were evenly distributed over each creek. All traps were set in water depths ranging from 0.40 to 1.5 m. Sample locations were recorded using a Garmin GPS unit. Minnow traps were not set during the fall due to poor results obtained during the summer sampling period.

Gee Minnow Traps

3.0 RESULTS

3.1 FISH HABITAT ASSESSMENT

Substrate, water flow, pool depth, slope, channel width, water temperature, and water quality characteristics were assessed at numerous sampling sites within both Whitefish Lake tributaries. Refer to sections 3.1.1 to 3.1.8 for results of each of the parameters examined.

3.1.1 AERIAL SURVEYS

Aerial photographs taken while conducting this project are displayed within three different sections of the report. In Figures 3 and 4, representative aerial photographs are displayed for both Lagoon Creek and North Creek respectively. These photographs were captured at an altitude of approximately 500 feet. The entire lengths of each tributary are also displayed in Appendix A and B for Lagoon Creek and North Creek respectively. All the digital photographs were pieced together to make it easy to visualize the types of habitats and barriers found within each of the tributaries examined. Within the overview of each creek, potential barriers to fish movement and the sampling locations are displayed. Finally, all the aerial photographs taken for both creeks and time periods can be found on the attached cd. All photographs are organized and separated into folders, identified by the creek name and flight date. In addition, files compatible with MapSource and ArcView, are included on the cd. The MapSource and ArcView files allow one to display the flight path and location of the individual photographs.

3.1.2 GROUND SURVEYS

Photographs of the habitat within each creek are displayed on Figures 5 and 6 for Lagoon Creek and North Creek respectively. Similar to the aerial photographs, the ground truthing photographs can all be found on the attached cd.

Figure 3. Lagoon Creek Aerial Photographs


Lagoon Creek
AAE Tech Services
N 52.331547° W 101.584524°
07/09/2009 11:04:17 AM


Lagoon Creek
AAE Tech Services
N 52.333703° W 101.581534°
07/09/2009 11:04:24 AM


Lagoon Creek
AAE Tech Services
N 52.334218° W 101.577131°
07/09/2009 11:04:32 AM


Lagoon Creek
AAE Tech Services
N 52.336845° W 101.574806°
07/09/2009 11:04:39 AM


Lagoon Creek
AAE Tech Services
N 52.337008° W 101.564933°
07/09/2009 11:04:56 AM


Lagoon Creek
AAE Tech Services
N 52.335554° W 101.550628°
07/09/2009 11:05:21 AM


Lagoon Creek
AAE Tech Services
N 52.335902° W 101.544105°
07/09/2009 11:05:32 AM


Lagoon Creek
AAE Tech Services
N 52.336823° W 101.537719°
07/09/2009 11:05:43 AM


Lagoon Creek
AAE Tech Services
N 52.337689° W 101.532956°
07/09/2009 11:05:51 AM

Figure 4. North Creek Aerial Photographs


North Creek
AAE Tech Services Inc.
N 52.349287° W 101.619487°
09/19/2009 10:15:58 AM


North Creek
AAE Tech Services Inc.
N 52.357258° W 101.616940°
09/19/2009 10:16:30 AM


North Creek
AAE Tech Services Inc.
N 52.361223° W 101.623275°
09/19/2009 10:16:49 AM


North Creek
AAE Tech Services Inc.
N 52.370782° W 101.620277°
09/19/2009 10:18:38 AM


North Creek
AAE Tech Services Inc.
N 52.402537° W 101.608742°
09/19/2009 10:26:13 AM


North Creek
AAE Tech Services Inc.
N 52.356151° W 101.618164°
09/19/2009 10:45:30 AM


North Creek
AAE Tech Services Inc.
N 52.360903° W 101.623681°
09/19/2009 10:45:49 AM


North Creek
AAE Tech Services
N 52.364520° W 101.625376°
07/09/2009 11:15:21 AM


North Creek
AAE Tech Services
N 52.362322° W 101.622680°
07/09/2009 11:15:10 AM

Figure 5. Lagoon Creek Ground Photographs


Lagoon Creek
AAE Tech Services
N 52.340227° W 101.572915°
07/10/2009 1:21:06 PM


Lagoon Creek
AAE Tech Services
N 52.340260° W 101.572018°
07/10/2009 1:23:20 PM


Lagoon Creek
AAE Tech Services
N 52.340223° W 101.570423°
07/10/2009 1:49:41 PM


Lagoon Creek
AAE Tech Services
N 52.340224° W 101.570423°
07/10/2009 1:49:49 PM

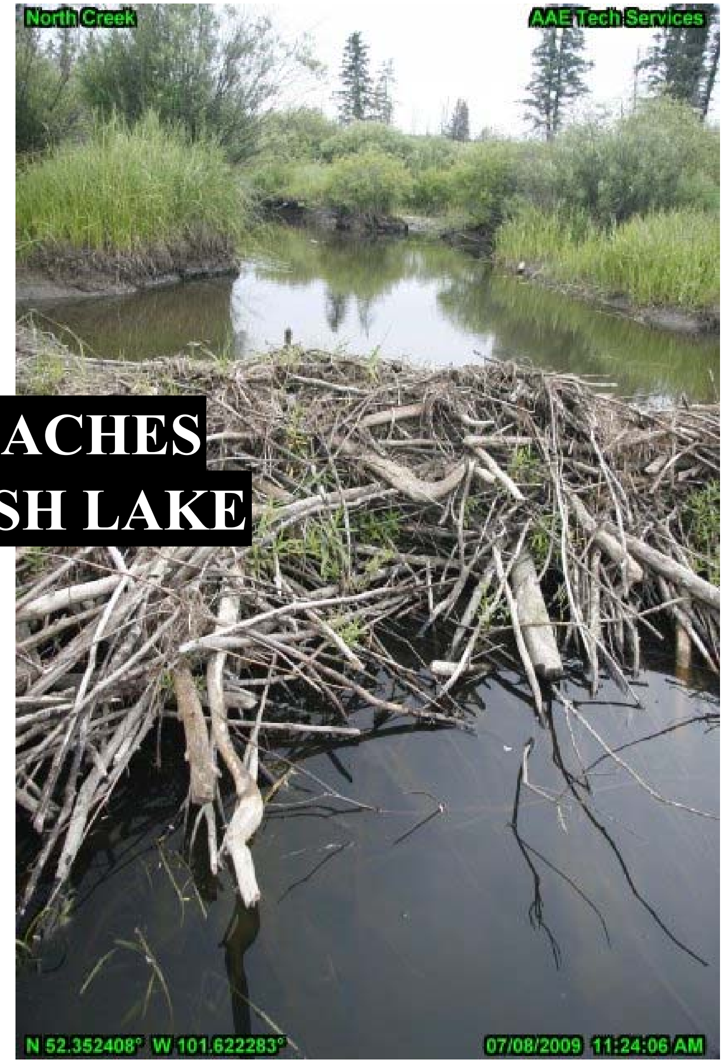

Lagoon Creek
AAE Tech Services
N 52.340193° W 101.570294°
07/10/2009 1:52:10 PM


Lagoon Creek
AAE Tech Services
N 52.339841° W 101.569451°
07/10/2009 2:20:27 PM

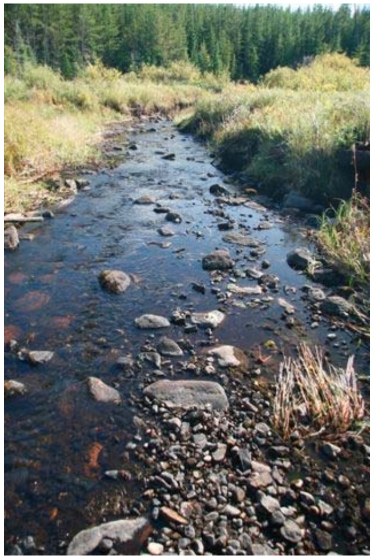

Lagoon Creek
AAE Tech Services
N 52.339583° W 101.566662°
07/10/2009 2:45:46 PM

Figure 6. North Creek Ground Photographs

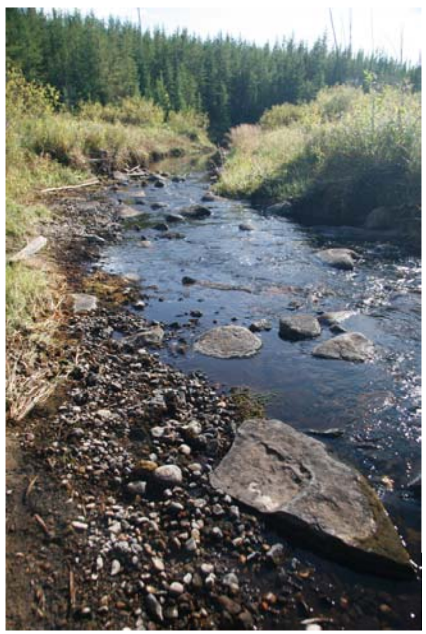
LOWER SAMPLING REACHES WITH 1KM OF WHITEFISH LAKE



APPROXIMATELY 1 KM UPSTREAM



APPROXIMATELY 4 KM UPSTREAM
EXCELLENT WALLEYE SPAWNING HABITAT



3.1.3 LONGITUDINAL PROFILE

Refer to Figure 9 for the longitudinal profiles for North Creek and Lagoon Creek. The slope of Lagoon Creek is approximately 0.36% using the topographic maps. Calculating the slope by the modified sampling approach resulted in a slope of 0.24% (Figure 10). Overall the slope within Lagoon Creek was moderate. Many large pools were created as a result of beaver activity (Figure 10). An additional factor causing the large pools, not including the beaver dams, is the gentle slope within the creek.

In contrast, the slope on North Creek was steeper than that documented for Lagoon Creek (0.48%). However, due to beaver activity, braided channels were formed with increased meanders, reducing the overall slope of the river. Because water travels a greater distance around meanders the slope of the river was reduced. Water velocities were also therefore reduced. Higher velocities result in the natural formation of run/riffle/pool sequences, ultimately increasing habitat diversity and providing better spawning habitat (Newbury, Gaboury, 1993).

3.1.4 CROSS-SECTIONAL PROFILES

Cross-sectional profiles for reach #1, #2 and, #3 of Lagoon Creek and North Creek are shown below in Figure 7 and 8 respectively. Cross sections were conducted from July 10th to 17th.

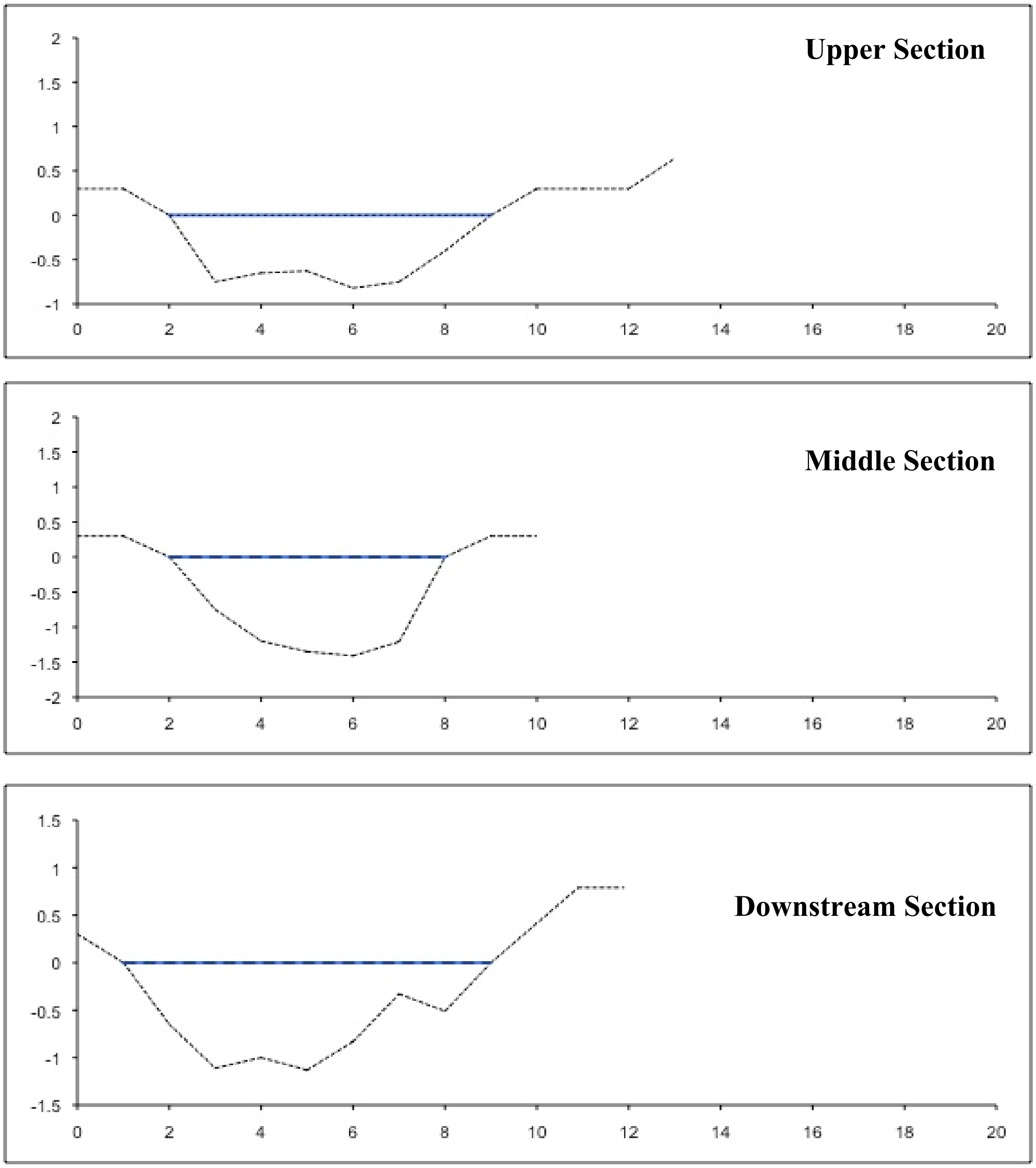


Figure 7. Cross-sectional profiles for Lagoon Creek, 2009. Upstream (N52.33975 W101.56758), Middle (N52.34048 W101.57560), and Downstream (N52.33695 W101.58644).

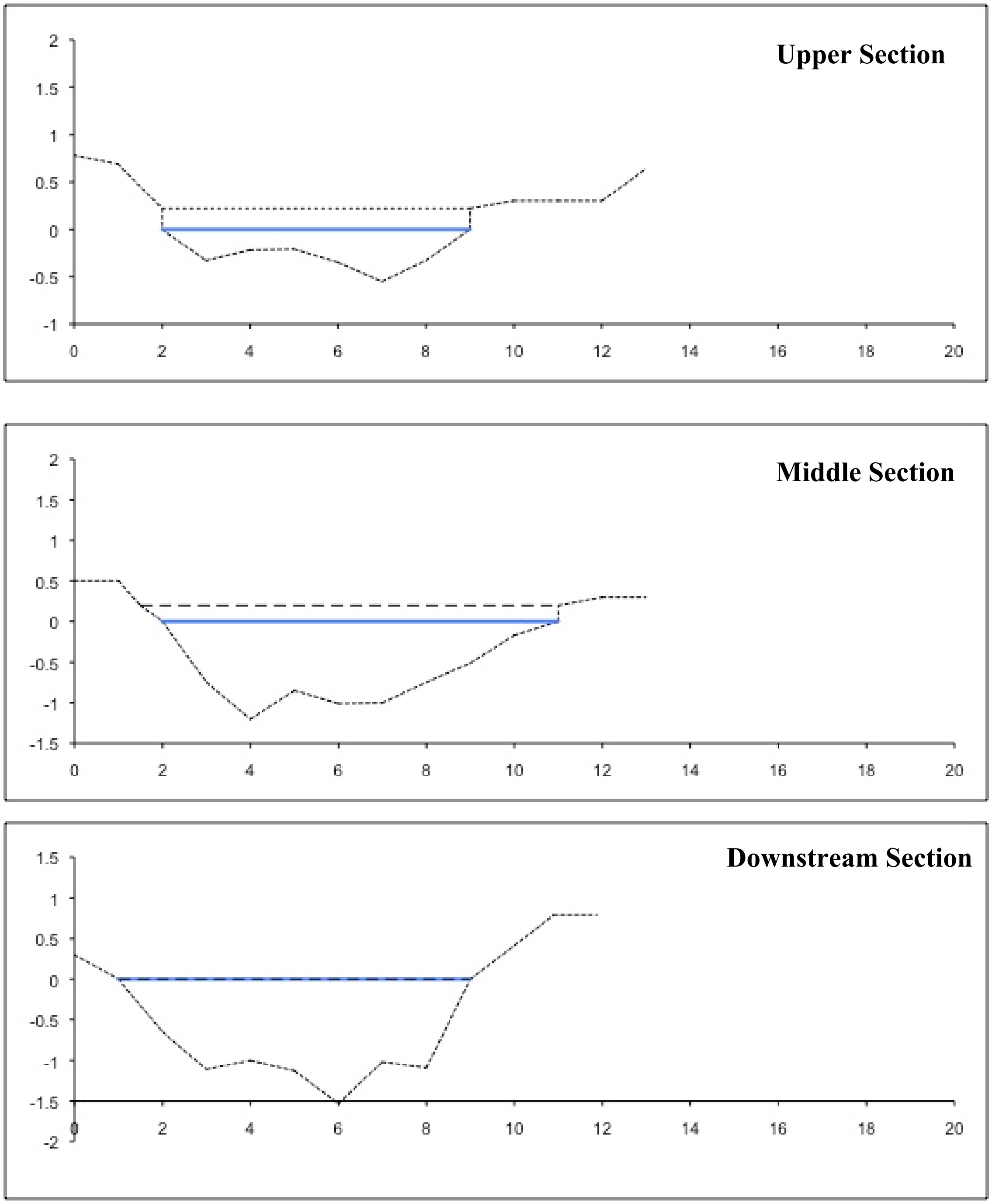


Figure 8. Cross-sectional profiles for North Creek, 2009. Upstream (N52.35804 W101.62051), Middle (N52.35516 W101.62045), and Downstream (N52.35241 W101.62229).

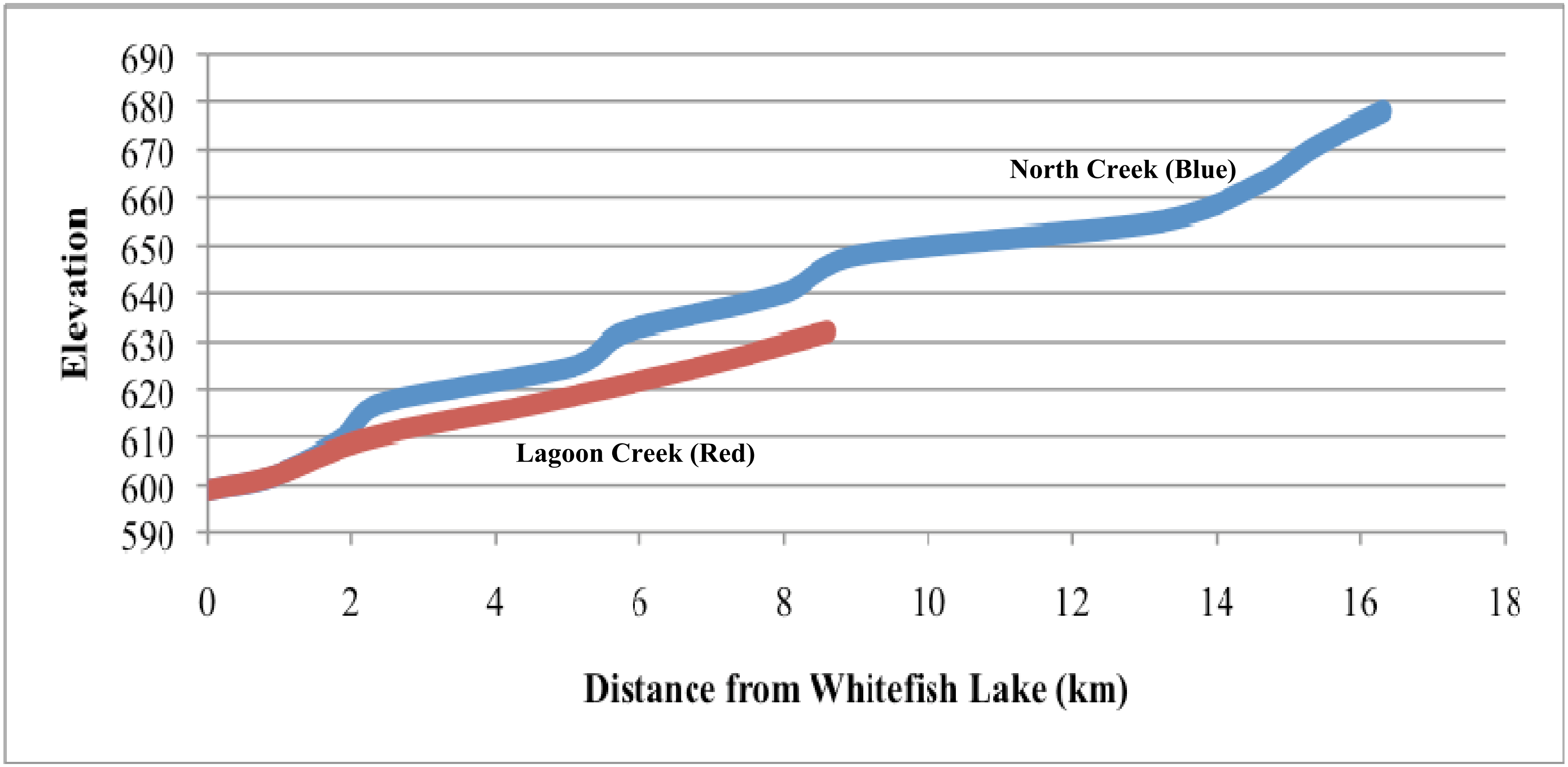


Figure 9. Longitudinal profiles for both North Creek and Lagoon Creek.

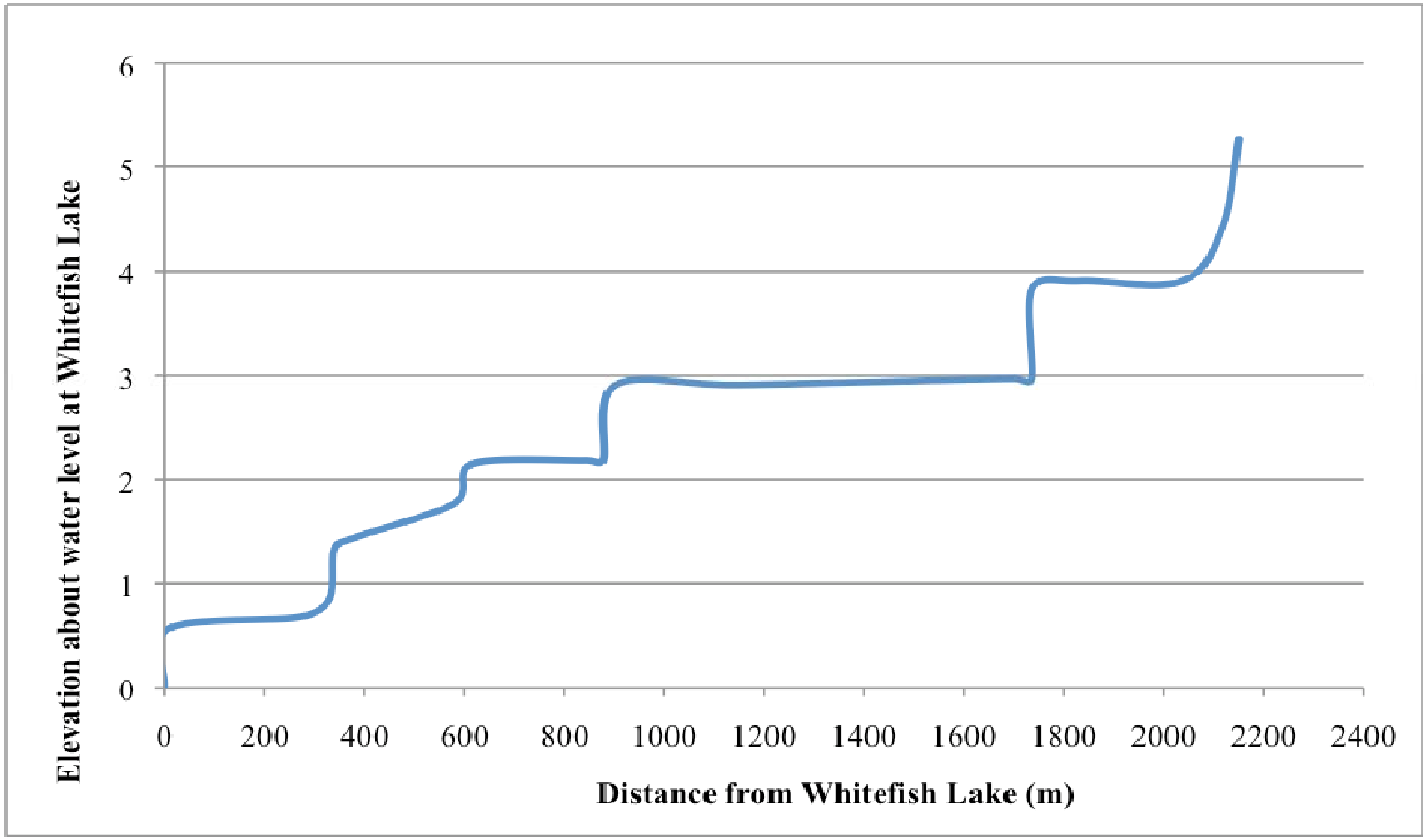


Figure 10. Lagoon Creek longitudinal profile based on water elevations at beaver dams locations within the creek. Notice the steep inclines at beaver dam locations.

3.1.5 FLOW

Water velocity data was not collected for this study as both creeks were under "no flow" conditions as a result of multiple beaver dams. Removing dams within the creek will likely result in flow returning back to its natural state, increasing habitat diversity and creating additional spawning habitat for the fish communities of Whitefish Lake.

3.1.6 BED PAVING MATERIALS

Bed paving materials were documented during field surveys and with the use of the aerial photography. Silt and fine particles made up the majority of the substrates observed within Lagoon Creek. Larger particles (boulders/cobble), although not observed within the lower reaches (5 km) of the creek, were identified at a few upstream locations (Appendix A). Gravel was also rare, only being observed at a few beaver dam locations within the lower sections of the creek. Water depths greater than 1.0 m made it difficult to visually inspect the substrate types using the aerial photographs. It was also difficult to identify all the substrate types found within the creek as more course substrates (gravel, cobble, boulder) were most often covered with finer materials. With the removal of the beaver dams within the creek, finer sediments would likely be swept clean within the main channel during high flow conditions, i.e. spring runoff or flood events. Additional spawning habitat would likely result. This would however, need to be documented.

Greater amounts of course substrates were observed within North Creek in comparison with Lagoon Creek. Within the first 400 m of the creek there were a number of gravel and sand outcroppings, created by high flow conditions. Course material deposited along the meanders increase fish habitat diversity within the creek. Moving upstream the outcroppings of rock, sand, and gravel continued. The North Creek was however, extremely altered as a result of beaver activity. Flows naturally shaping the channel were restricted as beavers plugged the system. Water flowing within a channel was typically directed to the edges on the beaver dam, thus creating new braided channels within this system. To summarize, the bottom third of the creek (0.4-1.5 km) was braided. At 1.5 km upstream of Whitefish Lake, good spawning habitat is evident (Appendix B). The good spawning habitat continues for approximately 800 m and then the creek becomes braided for another 2 km. At the 4.0 km mark, there is ideal spawning habitat, with the presence of riffle/run/pool habitat characteristics observed. Refer to Figure 6 for digital images of this habitat type. Upstream was however blocked by a significant beaver dam. Flow passing through this section during the spring runoff, with the beaver dam in-place would be insignificant to provide ideal spawning habitat conditions.

3.1.7 WATER TEMERATURE

Temperature loggers were placed within the creek to get a better understanding of the temperature ranges occurring within the creek during the summer and fall of 2009. It was important to see if water temperatures reached critical levels within the pool habitats created by the beaver dams. Warm water, compared to cool water, does not carry the same amount of dissolved oxygen, and therefore could potentially lead to summer fish kills.

The results during the project indicated temperature ranges were well within the tolerance levels of most fish species within both Lagoon and North creeks. Temperature range for Lagoon Creek was 11.4 to 17.5°C (Figures 11 and 12). The temperature range for North Creek of 10.3 to 22.6°C was slightly higher than found within Lagoon Creek (Figures 13 and 14). Water reached higher temperatures during the day and lower temperatures at night as a result of the smaller volume of water within the shallow pools located on North Creek.

3.1.8 WATER QUALITY

All water quality results are well within the normal range for Manitoba surface water (Table 1). Dissolved oxygen levels were above 7.8 mg/l indicating fish kills within each creek are unlikely. Turbidity was slightly higher within both creeks.

Table 1. Water quality parameters measured on the Whitefish Lake tributaries.

Creek	Date	Time	Temp (ºC)	Dissolved Oxygen (mg/L)	Conductivity (µs/cm)	pH	Turbidity
North	9-Jul-09	10:30	15.4	7.69	475	7.1	4.02
North	10-Jul-09	11:30	15.1	7.45	476	7.2	3.98
North	11-Jul-09	12:25	16.1	7.55	470	7.1	4.40
North	12-Jul-09	11:00	16.3	7.88	471	7.1	4.37
North	13-Jul-09	10:00	16.9	7.99	477	7.1	4.33
North	18-Sept-09	14:10	16.0	10.39	475	7.2	0.45
Lagoon	9-Jul-09	11:10	14.4	12.8	415	7.4	0.37
Lagoon	12-Jul-09	11:45	13.1	12.4	415	7.3	0.45
Lagoon	13-Jul-09	12:05	14.8	12.4	416	7.2	0.42
Lagoon	14-Jul-09	13:00	14.3	10.6	413	7.1	0.44
Lagoon	16-Sep-09	12:20	13.9	10.6	416	7.0	0.64
Lagoon	17-Sep-09	13:00	13.3	10.3	413	7.1	0.69
Lagoon	18-Sep-09	11:10	13.0	10.33	415	7.1	0.72

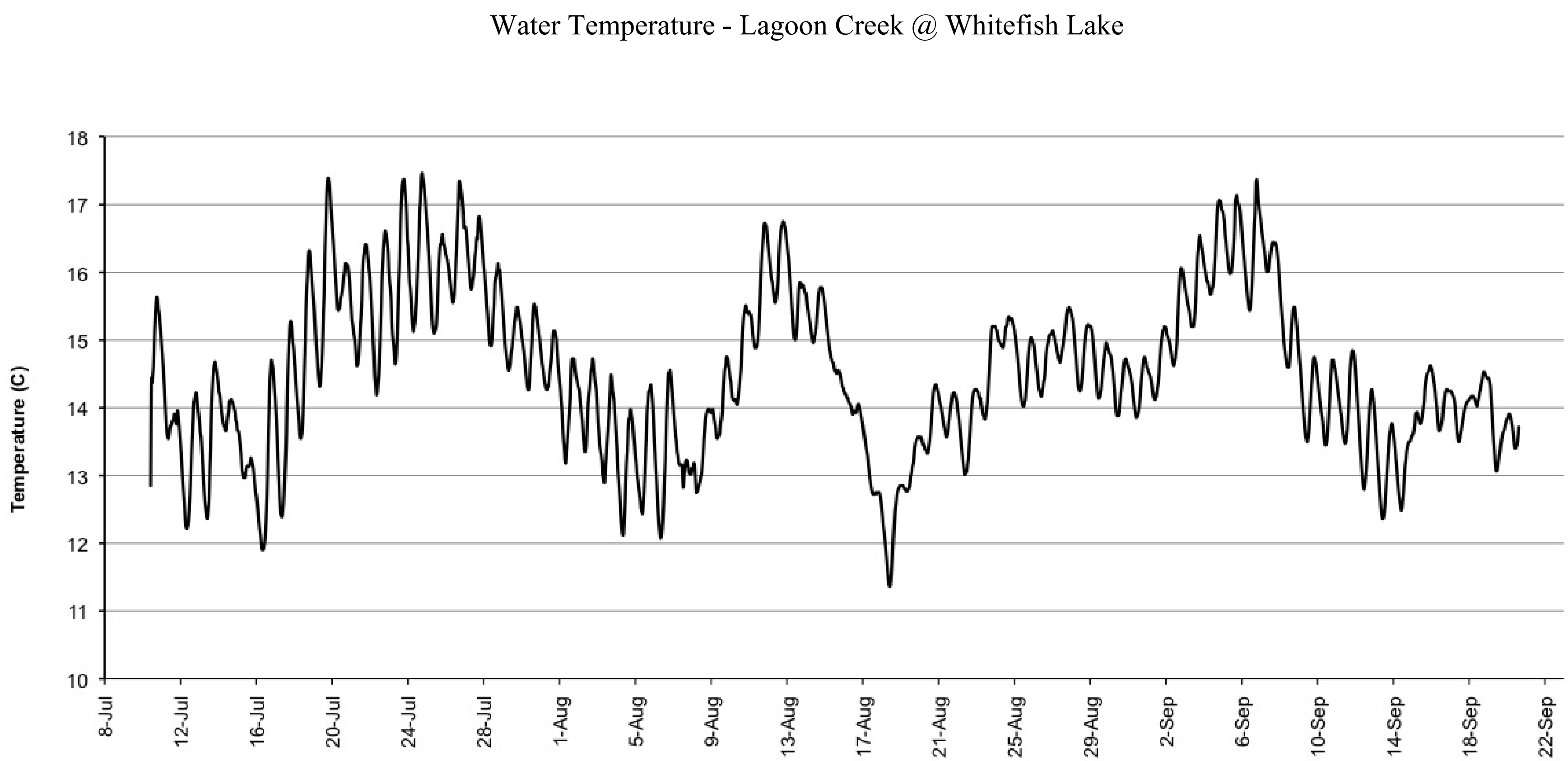


Figure 11. Water temperature (ºC) data for the Lagoon Creek near Whitefish Lake (N52.33695 W101.58644)

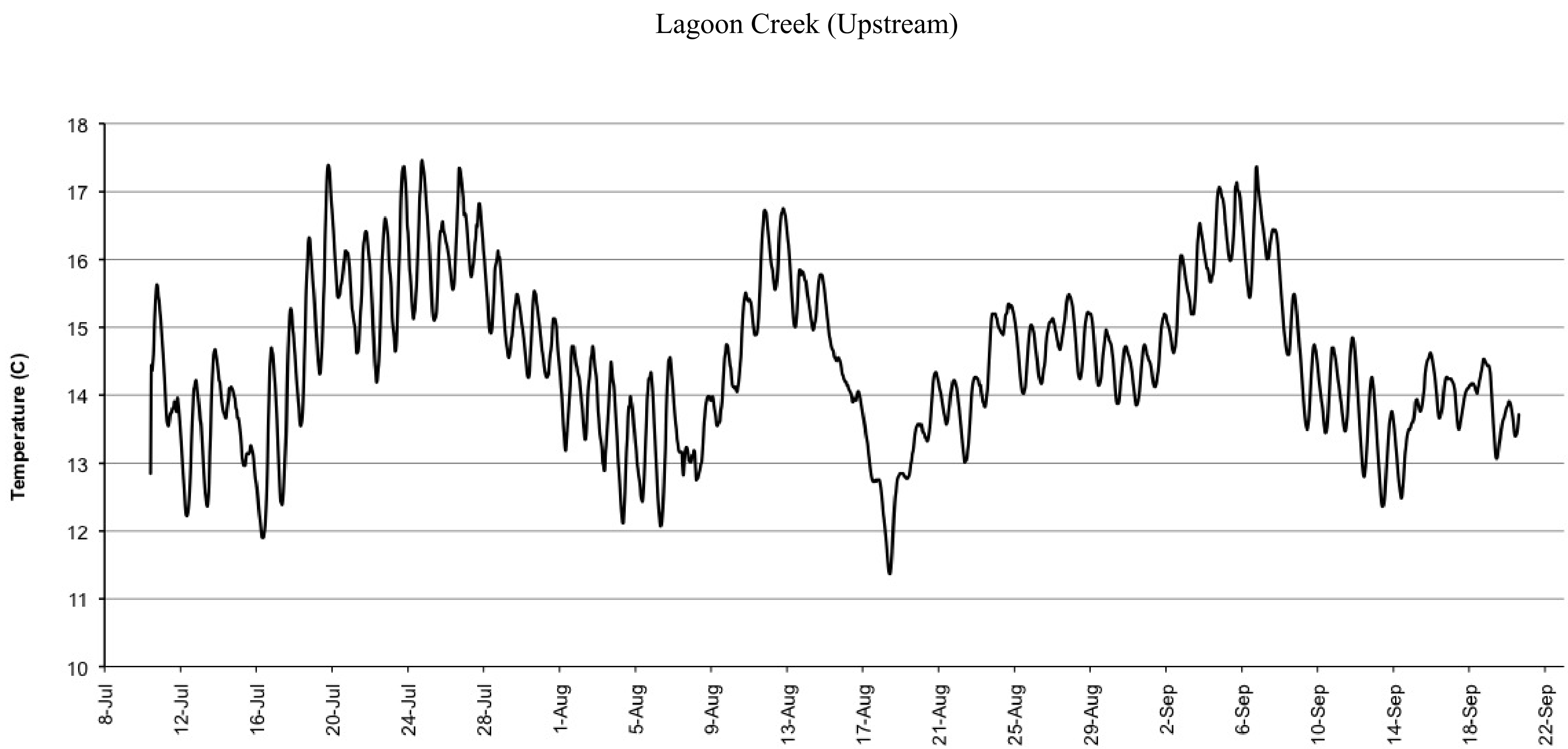


Figure 12. Water temperature (ºC) data for the Lagoon Creek upstream (N52.34048 W101.57560).

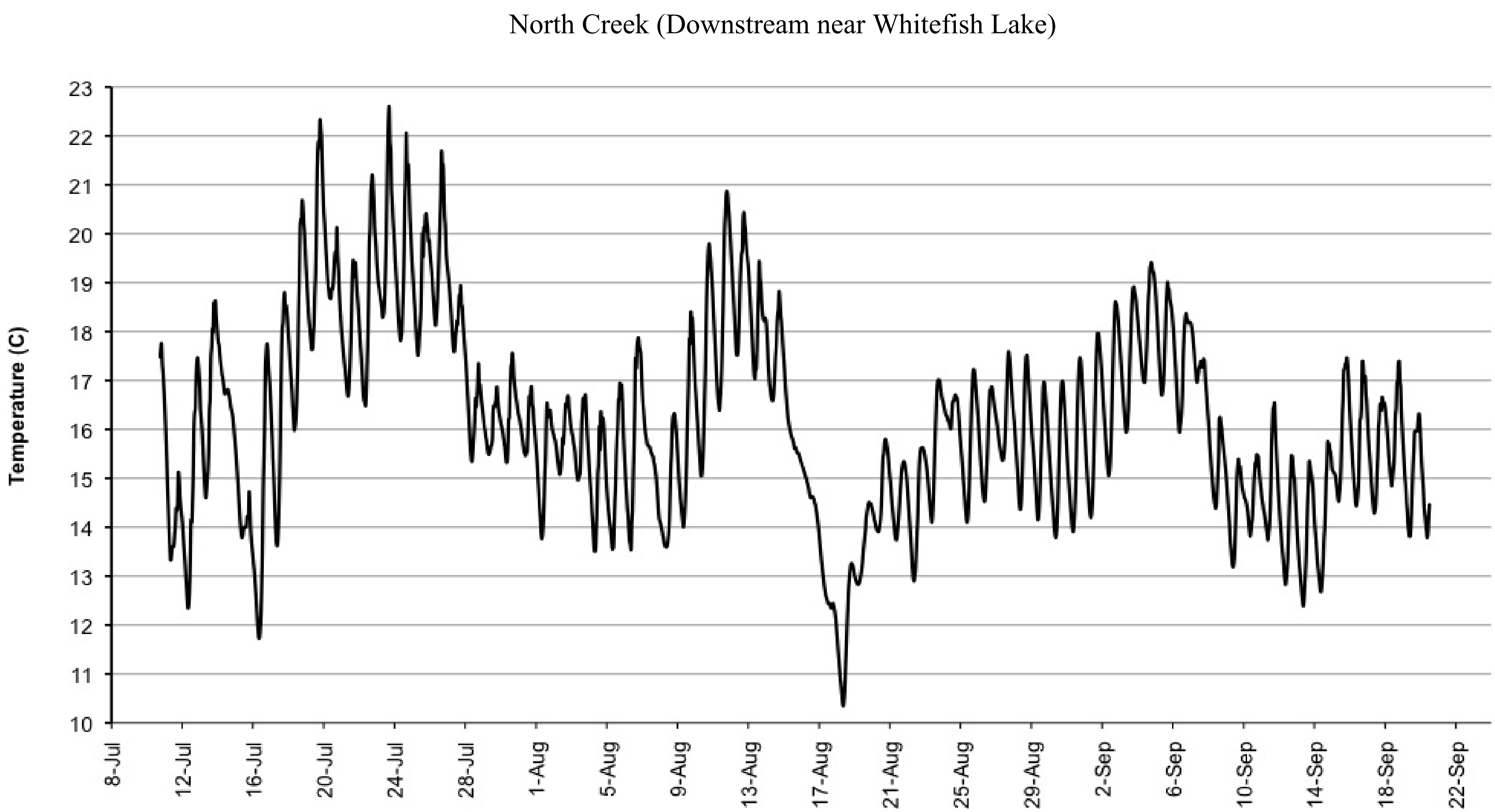


Figure 13. Water temperature (ºC) data for the North Creek near Whitefish Lake (N52.35241 W101.62229).

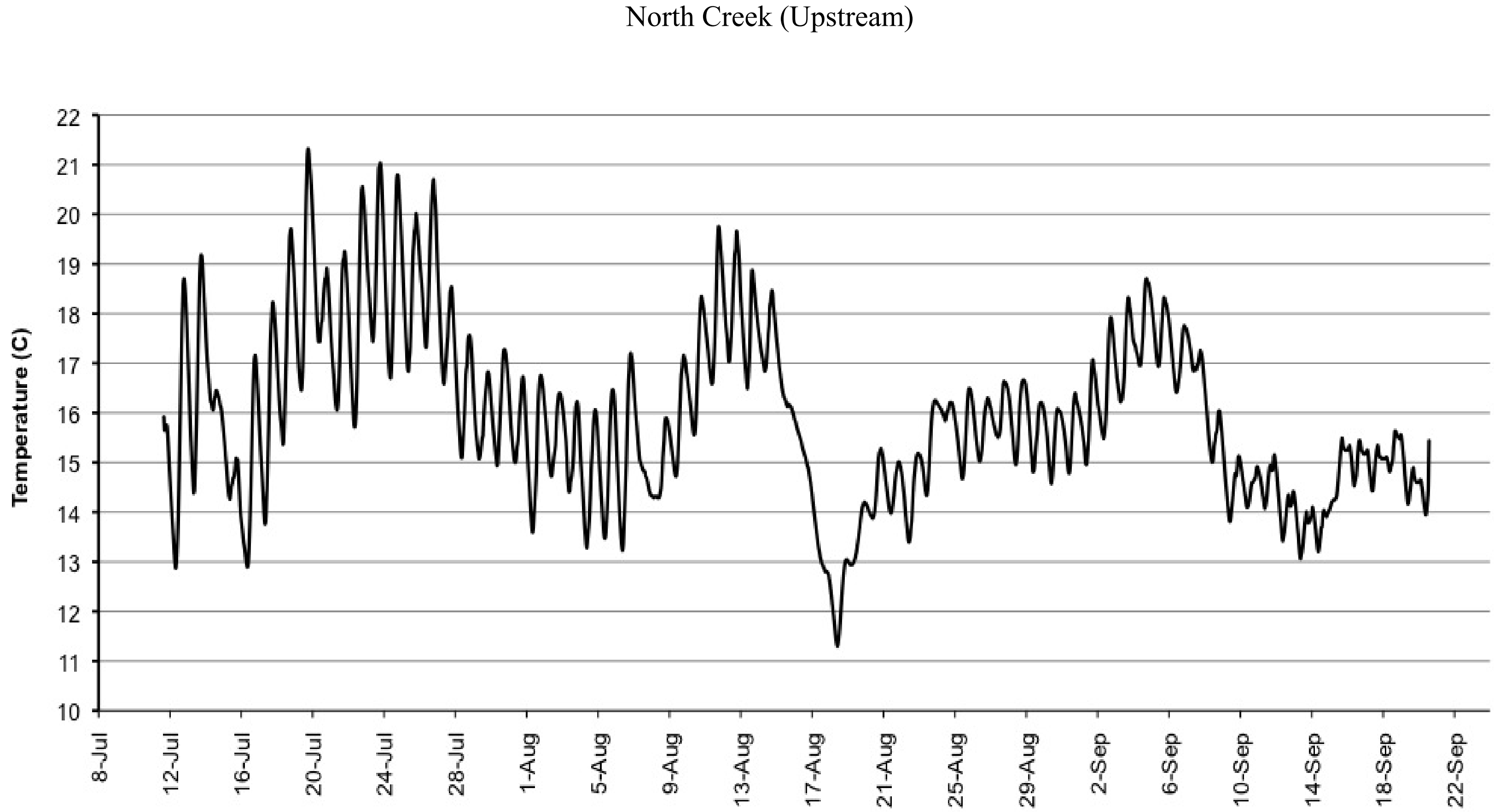


Figure 14. Water temperature (ºC) data for the North Creek upstream (N52.35804 W101.62051).

3.2 FISH COMMUNITY INVENTORY

A total of 659 fish, representing 15 species were captured within the two Whitefish Lake tributaries (Appendix C). Photographs of representative specimens are displayed in Figure 15. Common Shiners (*Luxilus cornutus*) and Fathead Minnow (*Pimephales promela*) were the dominant fish species found within Lagoon Creek representing 61 and 31% of the catch respectively. Brook Stickleback (*Culaea inconstans*), Johnny Darter (*Etheostoma nigrum*), Finescale Dace (*Phoxinus neogaeus*), and Western Blacknose Dace (*Rhinichthys obtusus*) were also found within Lagoon Creek. All of these fish likely over-winter within the creek. White Sucker (*Catostomus commersonii*), Yellow Perch (*Perca flavescens*), Northern Pike (*Esox lucius*), and Walleye (*Sander vitreus*) were not captured within the creek. Commonly found within Whitefish Lake, suggest the barriers situated within Lagoon Creek most likely impede all fish movement.

On North Creek there was a more diverse fish community. From Whitefish Lake to approximately 1.5 km upstream, White Sucker, Northern Pike, Spottail Shiner (*Notropis hudsonius*), Yellow Perch, Western Blacknose Dace, Burbot (*Lota lota*), Longnose Dace (*Rhinichthys cataractae*), Johnny Darter, Iowa Darter (*Etheostoma exile*), Fathead Minnow, Brook Stickleback, and Creek Chub (*Semotilus atromaculatus*) were commonly found. The fish community approximately 4.0 km upstream within North Creek was similar but with a reduced number of species (n = 8). Western Blacknose Dace, Creek Chub, and Fathead Minnow were the most abundant fish captured (Appendix C).

In addition to conducting the fish surveys, a literature search was conducted to identify those fish potentially found within the Whitefish Lake Watershed (Stewart and Watkinson, 2005). A total of 45 species are currently found within the Lake Winnipegosis Watershed. Of those species 21 have been confirmed within the Whitefish Lake Watershed. Note, several fish species are included in the list that are likely not found within the watershed as they were introduced into the Duck Mountains Provincial Park years prior (Table 2). The survival of these fish is unknown.

Figure 15. Photos of representative fish species capture during the fish inventory on the Whitefish Lake Tributaries, 2009. A – White sucker, B – Creek Chub, C –Spottail Shiner, D – Johnny Darter, E – Iowa Darter, F – Northern Pike, G Common Shiner, H – Longnose Dace, I and J – Western Blacknose Dace, K – Brook Stickleback, L – Fathead Minnow, M – Yellow perch.

Table 2. A list of potential fish found within the Whitefish Lake Watershed (Stewart and Watkinson, 2004).

Common Name	Family	Genus	Species	Occurrence	COSEWIC Status	Known Occurrences
Common Carp	Cyprinidae	*Cyprinus*	*carpio*	Introduced	not listed	Duck Mtn. Pro. Park
Common Shiner	Cyprinidae	*Luxilus*	*cornutus*	Native	not listed	**Whitefish Lake Watershed**
Pearl Dace	Cyprinidae	*Margariscus*	*margarita*	Native	not listed	Lake Winnipegosis
Golden Shiner	Cyprinidae	*Notemigonus*	*crysoleucas*	Native	not listed	Lake Winnipegosis
Emerald Shiner	Cyprinidae	*Notropis*	*antherinoides*	Native	not listed	Lake Winnipegosis
Bigmouth Shiner	Cyprinidae	*Notropis*	*dorsalis*	Native, Tributaries	not listed	Lake Winnipegosis
Blackchin Shiner	Cyprinidae	*Notropis*	*heterodon*	Native	not listed	Mossy River
Blacknose Shinner	Cyprinidae	*Notropis*	*heterolepis*	Native	not listed	Lake Winnipegosis
Spottail Shiner	Cyprinidae	*Notropis*	*hudsonius*	Native	not listed	**Whitefish Lake Watershed**
Finescale Dace	Cyprinidae	*Phoxinus*	*neogaeus*	Native Rare, Tributaries	not listed	**Whitefish Lake Watershed**
Northern Redbelly Dace	Cyprinidae	*Phoxinus*	*eos*	Native Rare, Tributaries	not listed	Duck Mtn. Pro. Park
Fathead Minnow	Cyprinidae	*Pimephales*	*promelas*	Native	not listed	**Whitefish Lake Watershed**
Sand Shinner	Cyprinidae	*Notropis*	*stramineus*	Native	not listed	Duck Mtn. Pro. Park
Longnose Dace	Cyprinidae	*Rhinichthys*	*cataractae*	Native	not listed	**Whitefish Lake Watershed**
Western Blacknose Dace	Cyprinidae	*Rhinichthys*	*obtusus*	Native	not listed	**Whitefish Lake Watershed**
Creek Chub	Cyprinidae	*Semotilus*	*atromaculatus*	Native	not listed	**Whitefish Lake Watershed**
Quillback	Catostomidae	*Carpiodes*	*cyprinus*	Native	not listed	Lake Winnipegosis
White Sucker	Catostomidae	*Catostomus*	*commersonii*	Native	not listed	**Whitefish Lake Watershed**
Silver Redhorse	Catostomidae	*Moxostoma*	*anisurum*	Native	not listed	Lake Winnipegosis
Shorthead Redhorse	Catostomidae	*Moxostoma*	*macrolepidotum*	Native	not listed	Lake Winnipegosis
Northern Pike	Esocidae	*Esox*	*lucius*	Native	not listed	**Whitefish Lake Watershed**
Central Mudminnow	Umbridae	*Umbra*	*limi*	Native Recent	not listed	**Whitefish Lake Watershed**
Cisco	Salmonidae	*Coregonus*	*artedi*	Native	not listed	**Whitefish Lake Watershed**
Lake Whitefish	Salmonidae	*Coregonus*	*clupeaformis*	Native	not listed	**Whitefish Lake Watershed**
Westslope Cutthroat Trout	Salmonidae	*Oncorhynchus*	*clarkii lewisi*	Introduced, Duck Mtn. Pro. Park	not listed	Duck Mtn. Pro. Park*
Rainbow Trout	Salmonidae	*Oncorhynchus*	*mykiss*	Introduced	not listed	Duck Mtn. Pro. Park
Kokanee Salmon	Salmonidae	*Oncorhynchus*	*nerka*	Introduced, Duck Mtn. Pro. Park	not listed	Duck Mtn. Pro. Park*
Brown Trout	Salmonidae	*Salmo*	*trutta*	Introduced	not listed	Duck Mtn. Pro. Park
Brook Trout	Salmonidae	*Salvelinus*	*fontinalis*	Transplanted (Native Manitoba)	not listed	Duck Mtn. Pro. Park
Lake Trout	Salmonidae	*Salvelinus*	*namaycush*	Introduced, Duck Mtn. Pro. Park	not listed	Duck Mtn. Pro. Park
Trout Perch	Percopsidae	*Percopsis*	*omiscomaycus*	Native	not listed	**Whitefish Lake Watershed**
Burbot	Gadidae	*Lota*	*lota*	Native	not listed	**Whitefish Lake Watershed**
Brook Stickleback	Gasterosteidae	*Culaea*	*inconstans*	Native	not listed	**Whitefish Lake Watershed**
Ninespine Stickleback	Gasterosteidae	*Pungitius*	*pungitius*	Native	not listed	Lake Winnipegosis

Table 2. Continued…

Common Name	Family	Genus	Species	Occurrence	COSEWIC Status	Known Occurrences
Mottled Sculpin	Cottidae	*Cottus*	*bairdii*	Native	not listed	Lake Winnipegosis
Slimy Sculpin	Cottidae	*Cottus*	*cognatus*	Native	not listed	Lake Winnipegosis
Largemouth Bass	Centrarchidae	*Micropterus*	*salmoides*	Introduce, Failed	not listed	Duck Mtn. Pro. Park*
Iowa Darter	Percidae	*Etheostoma*	*exile*	Native	not listed	**Whitefish Lake Watershed**
Johnny Darter	Percidae	*Etheostoma*	*nigrum*	Native	not listed	**Whitefish Lake Watershed**
Yellow Perch	Percidae	*Perca*	*flavescens*	Native	not listed	**Whitefish Lake Watershed**
Logperch	Percidae	*Percina*	*caprodes*	Native	not listed	Lake Winnipegosis
Blackside Darter	Percidae	*Percina*	*maculata*	Native	not listed	**Whitefish Lake Watershed**
River Darter	Percidae	*Percina*	*shumardi*	Native	not listed	**Whitefish Lake Watershed**
Sauger	Percidae	*Sander*	*canadensis*	Native	not listed	Lake Winnipegosis
Walleye	Percidae	*Sander*	*vitreus*	Native	not listed	**Whitefish Lake Watershed**

4.0 DISCUSSION

The Swan Valley Sport Fishing Enhancement (SVSFE) group is committed to protect and improve the recreational fishery on Whitefish Lake, one of the most heavily fished lakes within the Swan Lake Watershed. Currently a slot length limit of 45-70 cm appears to be helping maintain a healthy Walleye fishery on the lake. However, with the loss of valuable spawning habitat, as a result of beaver activity, the fishery is under constant pressure. To alleviate some of the pressure on the fishing community steps must be taken to help maintain and improve the access to the valuable spawning habitats within the tributaries of Whitefish Lake.

In 1996 and 2001, Provincial Fisheries Biologist conducted index-netting surveys to obtain baseline data of the age and catch per unit effort (CUE) of the fish community within Whitefish Lake (Appendix E). Walleye, Northern Pike, Whitefish, Cisco, Yellow Perch, and White Sucker were examined during both surveys. Manitoba Conservation has also been actively involved with the fishery by conducting head counts of those fish filleted within the SVSFE filleting shed (Appendix D). This modified creel survey is an important asset to help fisheries biologist understand the pressure exerted on the fishery by the angling community. Telemetry studies were also conducted on Whitefish Lake in 2005. A total of eight Walleye were captured, tagged, and released. During the spring spawning run all eight fish made their way to either North Creek or Lagoon Creek, signifying the importance of tributaries to the fish community as valuable spawning habitat.

The Swan Valley Sport Fishing Enhancement Group initiated this study to help restore the tributaries flowing into Whitefish Lake. The importance of these tributaries to maintaining a healthy fish population is essential. Tributaries in general provide excellent spawning habitat for numerous fish species including, Walleye, Northern Pike, Yellow Perch, White Sucker, and many cyprinid species (minnows) to name a few. The overall fish community within Whitefish Lake will benefit if the tributaries are restored to their natural state. Currently, beaver dams have created impassible barriers along each creek, forcing the Whitefish Lake fish to spawn along the lake shoreline. These systems must be maintained on a regular basis to provide the proper spawning habitat for the Whitefish Lake fish community. In addition, forage fish will also benefit with the additional spawning habitat and therefore help improve the entire fishery.

The results of this survey provided much needed data to understand the fish habitat and fish communities utilizing the two Whitefish Lake creeks. A beaver management program also included within this report describing a number of recommended steps that need to be taken to help restore the habitat within each creek. This survey also provided baseline data as to the habitat characteristic within the creek prior to any restoration efforts. Future studies could essentially be conducted to verify if the restoration efforts are successful once they are in fact complete. Recommendations are also suggested within this survey on how to improve the current fish habitat within the Whitefish Lake tributaries.

5.0 RECOMMENDATIONS

The recommendations below are based on the results of this study and discussions had with the SVSFE group and Provincial and Federal Government Agencies.

- Remove all barriers on both creeks to provide additional spawning habitat for the Whitefish Lake fish community. Refer to the next section for recommended beaver management practices.

- Conduct studies to identify whether fish are utilizing the tributaries once the restoration efforts are completed. Monies are going to have to be spent annually to keep these systems open and functioning properly. Therefore, it is important to verify and prove fish are utilizing these tributaries for spawning. Larval drift-nets and egg sampling can be done to assess successful larval emergence.

- Conduct telemetry or adult fish surveys during the spawning run to verify fish are utilizing the tributaries.

- Conduct aerial surveys either on an annual basis or every other year to document the changes taking place to the habitat once restored. Habitat diversity will likely increase and provide additional habitat to the fish communities utilizing the tributaries. The cost to benefit ratio for conducting aerial surveys annually is minimum. It is relatively inexpensive to conduct an hour flight taking still images to document habitat changes. Positive results will help obtain future funding for habitat restoration projects within the area.

- Conduct regular index-netting surveys to examine catch per unit effort and monitor the recreational fishery on Whitefish Lake.

- Conduct creel surveys for numerous years to get a better understanding of fishing pressure on Whitefish Lake. Fishing pressure will differ from year to year and therefore it is important to conduct the survey over multiple years to get meaningful data.

5.1 BEAVER MANAGEMENT PROTOCOL

In order to successfully restore and rehabilitate the spawning habitat within North Creek and Lagoon Creek, a beaver management program is going to have to be followed. However, both creeks are found along a trap-line and therefore, the SVSFE group is going to have to partner with the beaver trapper to achieve the ultimate goal of improving fish spawning habitat within each Whitefish Lake tributary. Furthermore, while discussing potential beaver management practices with the trapper, it became evident a number of issues must be resolved before all the dams can be removed. The most important issue mentioned is the timing of beaver dam removal. Access to each creek is limited year round, with the exception in the winter, where thick ice within the creeks provides the means to maneuver up and down each creek safely. Furs are also most attractive during the winter months as their value is at their highest peak.

Below are a number of recommended steps that AAE Tech Services feels will provide a guideline to help restore and maintain the habitat within the Whitefish Lake tributaries. Prior to establishing this list, conversations were had with Provincial Fisheries Biologists, the SVSFE members and the local trapper. The recommendations will most likely meet the needs of all parties involved to help restore the habitat within the tributaries back to their natural state. Recommendations for each tributary vary slightly due to some concerns discussed in more detail below.

North Creek

The first step involved in restoring the spawning habitat within this creek is to remove all the beaver dams within the first few kilometers in March of 2010. Excellent Walleye spawning habitat was documented at 1.5 km upstream. To reach this habitat approximately 13 dams are going to have to be removed (Appendix B). To remove the dams, dynamite appears to be the only option. Dams must be removed in winter during the last week of February or within the early weeks of March of 2010. Removing the dams prior to February will infringe upon the trappers ability to trap furs along this creek. Also, to gain access to the creeks we recommend removing the dams near the middle of March to avoid potential conflicts with the approaching Walleye spawning run. The group must obtain permission from the Department of Fisheries and Oceans as there are restrictions are in place for using dynamite within waterways classified as fish habitat.

The second step involves monitoring the creek during the spring spawning run to document fish movement. Ten Walleye within Whitefish Lake currently have radio telemetry tags embedded along the base of their dorsal fin. Substantial effort should be put forth to verity the tagged fish ascend up the tributaries during spring runoff. It would also be beneficial to set a trap net within each creek to assess adult fish migration. This step is included, as it will help provide supporting documentation to the success of the restoration efforts.

The third step is to monitor the creek and potentially breech any dams being built during the spawning run. If dams are erected within the first month of the open water season, fry may become trapped behind these dams. It is recommended to have a volunteer or paid person take a quick trip up each tributary once a week or every other week to locate and remove potential new barriers. Walleye fry hatch in approximately 17 days in water temperatures averaging 13°C. Once hatched, it is not known how long the individual fry will remain within the creeks before making their way back to Whitefish Lake. They may descent within hours of hatching or take several weeks. Fish surveys would have to be completed to answer this question.

Two options are presented for the fourth step: 1) continue monitoring each creek once a month removing problem beaver dams; or 2) do nothing and start the entire process again in February.

Lagoon Creek

The only difference with the beaver management plan on Lagoon Creek and North Creek is we would not recommend removing all the dams on Lagoon Creek during the winter of 2010. The amount of water stored within Lagoon Creek is much greater than that observed within North Creek. In addition, downstream of Lagoon Creek is the Provincial Park campground. To avoid potentially flooding the campground, we would recommend removing the dams over an extended period of time. Removing some of the first dams within 2010 is important to allow fish to enter the creek during spring spawning to verify fish will utilize this habitat. Also it is recommended to remove as many dams as possible during the summer months to flush out and decrease the volume of water found within the creek. Removing dams by hand is difficult but not impossible. It would also be a relatively inexpensive endeavor to provide additional spawning habitat within Lagoon Creek.

The North West Interlake Water Management Association (NWIWMA) has been dealing with a similar type of a scenario on Lake Manitoba, a loss of valuable fish spawning habitat due to extensive beaver activity. The NWIWMA is however, having a great deal of success controlling problem beavers within the rehabilitated creeks, and bringing beaver numbers back to controllable levels (Lowdon, 2009). These same results can occur on both Whitefish Lake creeks if the group is committed to solving this problem to help improve and maintain the fishery on Whitefish Lake. The NWIWMA has also found that it has become easier over time and less expensive to keep these systems open once the creeks are restored back to their natural state.

6.0 ACKNOWLEDGEMENTS

Thanks to everyone on the Swan Valley Sport Fishing Enhancement Group for giving AAE Tech Services the opportunity to conduct this fish and habitat survey on the Whitefish Lake tributaries and for being so interested and helpful throughout the course of the study. Special thanks to Ken Lowdon and Melissa Johnson for assisting with fieldwork. Thanks to Jeff Connolly for his dedication and support to the Swan Valley Sport Fishing Enhancement Corporation. Thanks to Ian Kitch, Fisheries Biologist, Manitoba Water Stewardship, Swan River, Brent Erlendson and Holly Urban, Swan Lake Watershed Conservation District, for your help and support with this project. Thanks to Laureen Janusz for the collection permit.

7.0 REFERENCES

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APPENDIX A:
AERIAL PHOTOGRAPHS OF LAGOON CREEK

(flow is in the direction of right to left and top to bottom for the aerial photographs)




APPENDIX B: AERIAL PHOTOS NORTH CREEK

(photographs are moving upstream from Whitefish Lake, flow is therefore in the opposite direction – bottom left corner to top right)


North Creek
AAE Tech Services Inc.
N 52.352092° W 101.612326°
09/19/2009 11:07:45 AM


North Creek
AAE Tech Services Inc.
N 52.352577° W 101.612973°
09/19/2009 11:07:47 AM


North Creek
AAE Tech Services Inc.
N 52.354786° W 101.614651°
09/19/2009 11:07:55 AM


North Creek
AAE Tech Services Inc.
N 52.356354° W 101.614710°
09/19/2009 11:07:59 AM


North Creek
AAE Tech Services Inc.
N 52.360784° W 101.617378°
09/19/2009 11:08:13 AM

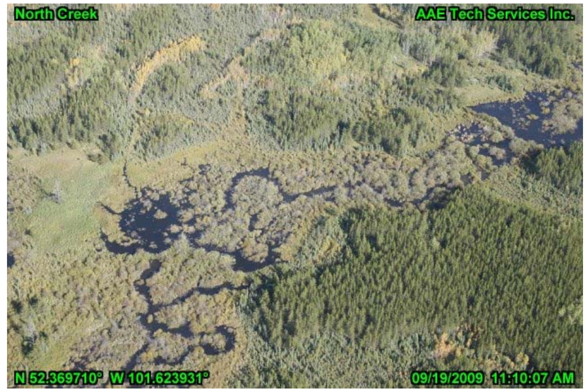

North Creek
AAE Tech Services Inc.
N 52.361941° W 101.618316°
09/19/2009 11:08:17 AM


North Creek
AAE Tech Services Inc.
N 52.365959° W 101.621287°
09/19/2009 11:08:31 AM


North Creek
AAE Tech Services Inc.
N 52.366521° W 101.621817°
09/19/2009 11:08:33 AM


North Creek
AAE Tech Services Inc.
N 52.369455° W 101.624307°
09/19/2009 11:08:43 AM


North Creek
AAE Tech Services Inc.
N 52.370691° W 101.625032°
09/19/2009 11:08:46 AM


North Creek
AAE Tech Services Inc.
N 52.369710° W 101.623931°
09/19/2009 11:10:07 AM


North Creek
AAE Tech Services Inc.
N 52.369335° W 101.621377°
09/19/2009 11:10:12 AM


North Creek
AAE Tech Services Inc.
N 52.371762° W 101.615058°
09/19/2009 11:10:26 AM


North Creek
AAE Tech Services Inc.
N 52.372311° W 101.614320°
09/19/2009 11:10:28 AM


North Creek
AAE Tech Services Inc.
N 52.374137° W 101.611163°
09/19/2009 11:10:37 AM


North Creek
AAE Tech Services Inc.
N 52.374500° W 101.610253°
09/19/2009 11:10:39 AM


North Creek
AAE Tech Services Inc.
N 52.375684° W 101.605582°
09/19/2009 11:10:48 AM


North Creek
AAE Tech Services Inc.
N 52.375791° W 101.604574°
09/19/2009 11:10:51 AM


North Creek
AAE Tech Services Inc.
N 52.375797° W 101.598623°
09/19/2009 11:11:02 AM


North Creek
AAE Tech Services Inc.
N 52.376005° W 101.596729°
09/19/2009 11:11:06 AM


North Creek
AAE Tech Services Inc.
N 52.377734° W 101.589822°
09/19/2009 11:11:20 AM


North Creek
AAE Tech Services Inc.
N 52.378460° W 101.587910°
09/19/2009 11:11:25 AM


North Creek
AAE Tech Services Inc.
N 52.380853° W 101.582246°
09/19/2009 11:11:38 AM


North Creek
AAE Tech Services Inc.
N 52.385980° W 101.576230°
09/19/2009 11:11:58 AM


North Creek
AAE Tech Services Inc.
N 52.387030° W 101.575042°
09/19/2009 11:12:01 AM


North Creek
AAE Tech Services Inc.
N 52.390352° W 101.571576°
09/19/2009 11:12:14 AM


North Creek
AAE Tech Services Inc.
N 52.390961° W 101.571106°
09/19/2009 11:12:16 AM


North Creek
AAE Tech Services Inc.
N 52.394647° W 101.568839°
09/19/2009 11:12:27 AM


North Creek
AAE Tech Services Inc.
N 52.395303° W 101.568622°
09/19/2009 11:12:30 AM


North Creek
AAE Tech Services Inc.
N 52.400001° W 101.568687°
09/19/2009 11:12:43 AM


North Creek
AAE Tech Services Inc.
N 52.401266° W 101.569227°
09/19/2009 11:12:47 AM

Appendix C. Fish captured with Whitefish Lake tributaries during the summer and fall of 2009. E = electrofishing; V = visual observation; D = dip-netting; M = minnow traps; S = seining.

Creek	Date	Latitude	Longitude	Method	Effort	Common Name	Genus	Species	Numbers Captured
North Creek	11-Jul-09	N52.35241	W101.62229	V	--	--	--	--	--
North Creek	09-Jul-09	N52.35241	W101.62229	V	--	Northern Pike	*Esox*	*lucius*	--
North Creek	09-Jul-09	N52.35262	W101.62244	E	208	Yellow Perch	*Perca*	*flavescens*	1
North Creek	09-Jul-09	N52.35262	W101.62244	E	208	Johnny Darter	*Etheostoma*	*nigrum*	3
North Creek	09-Jul-09	N52.35262	W101.62244	E	208	White Sucker	*Catostomus*	*commersonii*	2
North Creek	09-Jul-09	N52.35262	W101.62244	E	208	Iowa Darter	*Etheostoma*	*exile*	1
North Creek	09-Jul-09	N52.35262	W101.62244	E	208	Longnose Dace	*Rhinichthys*	*cataractae*	1
North Creek	09-Jul-09	N52.35349	W101.62262	E	103	Spottail Shiner	*Notropis*	*hudsonius*	1
North Creek	09-Jul-09	N52.35349	W101.62262	E	103	Northern Pike	*Esox*	*lucius*	1
North Creek	09-Jul-09	N52.35349	W101.62262	E	103	Johnny Darter	*Etheostoma*	*nigrum*	2
North Creek	09-Jul-09	N52.35412	W101.62186	E	90	Longnose Dace	*Rhinichthys*	*cataractae*	1
North Creek	09-Jul-09	N52.35412	W101.62186	E	90	Western Blacknose Dace	*Rhinichthys*	*obtusus*	5
North Creek	09-Jul-09	N52.35412	W101.62186	E	90	Johnny Darter	*Etheostoma*	*nigrum*	1
North Creek	09-Jul-09	N52.35516	W101.62045	E	225	White Sucker	*Catostomus*	*commersonii*	7
North Creek	09-Jul-09	N52.35516	W101.62045	E	225	Brook Stickleback	*Culaea*	*inconstans*	4
North Creek	09-Jul-09	N52.35516	W101.62045	E	225	Fathead Minnow	*Pimephales*	*promelas*	1
North Creek	09-Jul-09	N52.35516	W101.62045	E	225	Common Shiner	*Luxilus*	*cornutus*	1
North Creek	09-Jul-09	N52.35516	W101.62045	E	225	Longnose Dace	*Rhinichthys*	*cataractae*	4
North Creek	09-Jul-09	N52.35516	W101.62045	E	225	Creek Chub	*Semotilus*	*atromaculatus*	1
North Creek	09-Jul-09	N52.35808	W101.62057	E	306	Common Shiner	*Luxilus*	*cornutus*	2
North Creek	09-Jul-09	N52.35808	W101.62057	E	306	Longnose Dace	*Rhinichthys*	*cataractae*	13
North Creek	09-Jul-09	N52.35808	W101.62057	E	306	White Sucker	*Catostomus*	*commersonii*	3
North Creek	09-Jul-09	N52.35808	W101.62057	E	306	Brook Stickleback	*Culaea*	*inconstans*	4
North Creek	09-Jul-09	N52.35808	W101.62057	E	306	Western Blacknose Dace	*Rhinichthys*	*obtusus*	1
North Creek	09-Jul-09	N52.35808	W101.62057	E	306	Johnny Darter	*Etheostoma*	*nigrum*	2
North Creek	09-Jul-09	N52.35808	W101.62057	E	306	Burbot	*Lota*	*lota*	1
North Creek	09-Jul-09	N52.35015	W101.62089	M	24 hours	--	--	--	--
North Creek	09-Jul-09	N52.34891	W101.61938	M	24 hours	--	--	--	--
North Creek	09-Jul-09	N52.35261	W101.62245	M	24 hours	--	--	--	--
North Creek	18-Sep-09	N52.38373	W101.58694	E	178 sec	Western Blacknose Dace	*Rhinichthys*	*obtusus*	53
North Creek	18-Sep-09	N52.38373	W101.58694	E	178 sec	Longnose Dace	*Rhinichthys*	*cataractae*	1
North Creek	18-Sep-09	N52.38373	W101.58694	E	178 sec	Finescale Dace	*Phoxinus*	*neogaeus*	1
North Creek	18-Sep-09	N52.38373	W101.58694	E	178 sec	Common Shiner	*Luxilus*	*cornutus*	9
North Creek	18-Sep-09	N52.38373	W101.58694	E	178 sec	Creek Chub	*Semotilus*	*atromaculatus*	22

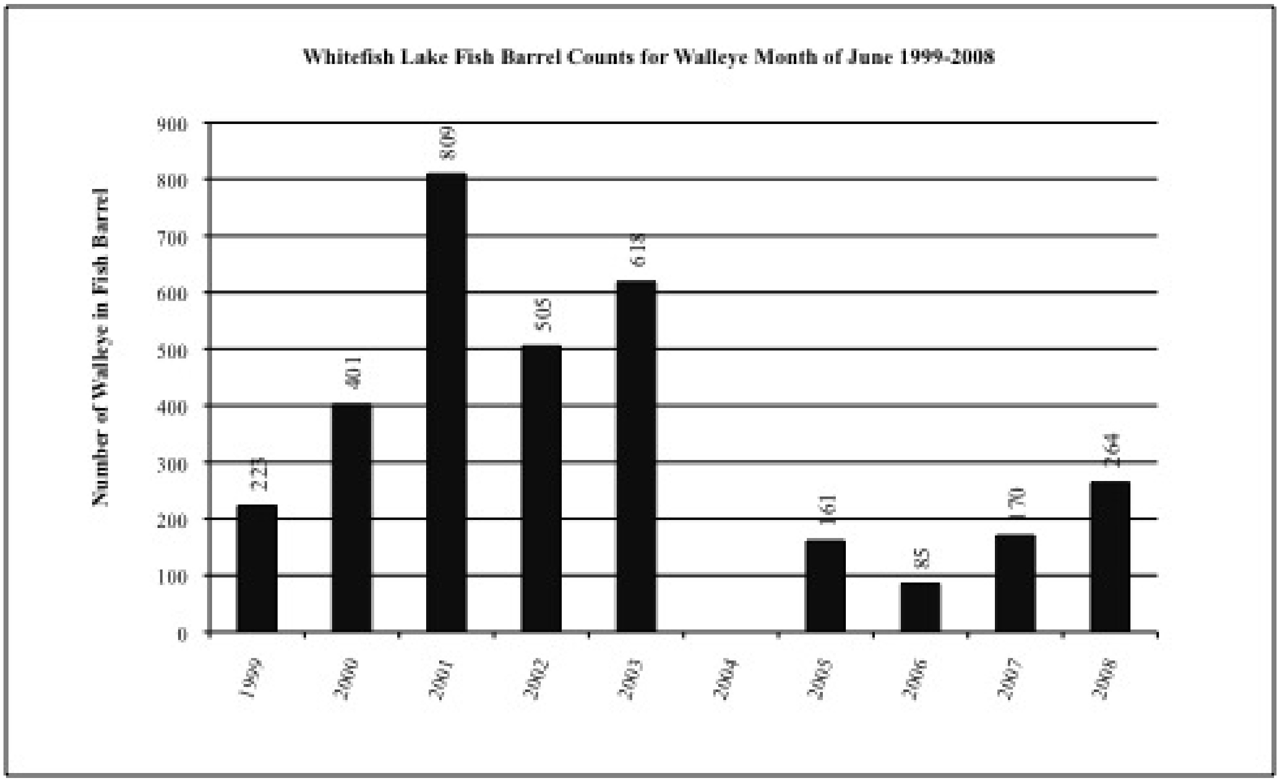
Appendix C. continued…

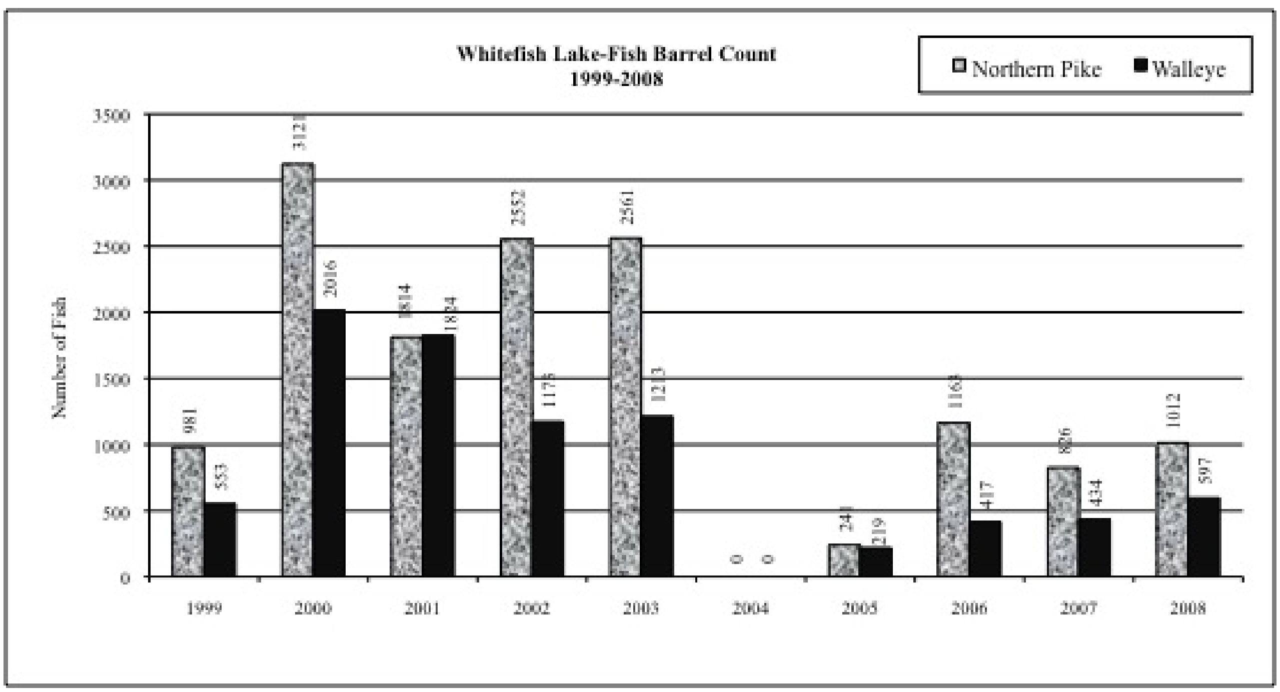
Creek	Date	Latitude	Longitude	Methods	Effort	Common Name	Genus	Species	Numbers Captured
North Creek	18-Sep-09	N52.38373	W101.58694	E	178 sec	White Sucker	*Catostomus*	*commersonii*	3
North Creek	18-Sep-09	N52.38373	W101.58694	E	178 sec	Brook Stickleback	*Culaea*	*inconstans*	3
North Creek	18-Sep-09	N52.38373	W101.58694	E	178 sec	Iowa Darter	*Etheostoma*	*exile*	9
North Creek	18-Sep-09	N52.38443	W101.58710	E	273 sec	Creek Chub	*Semotilus*	*atromaculatus*	69
North Creek	18-Sep-09	N52.38443	W101.58710	E	273 sec	Western Blacknose Dace	*Rhinichthys*	*obtusus*	50
North Creek	18-Sep-09	N52.38443	W101.58710	E	273 sec	Common Shiner	*Luxilus*	*cornutus*	3
North Creek	18-Sep-09	N52.38443	W101.58710	E	273 sec	Iowa Darter	*Etheostoma*	*exile*	9
North Creek	18-Sep-09	N52.38443	W101.58710	E	273 sec	Fathead Minnow	*Pimephales*	*promelas*	1
North Creek	18-Sep-09	N52.38443	W101.58710	E	273 sec	Brook Stickleback	*Culaea*	*inconstans*	6
North Creek	18-Sep-09	N52.38472	W101.58739	E	194 sec	Creek Chub	*Semotilus*	*atromaculatus*	49
North Creek	18-Sep-09	N52.38472	W101.58739	E	194 sec	Western Blacknose Dace	*Rhinichthys*	*obtusus*	120
North Creek	18-Sep-09	N52.38472	W101.58739	E	194 sec	Iowa Darter	*Etheostoma*	*exile*	9
North Creek	18-Sep-09	N52.38472	W101.58739	E	194 sec	Brook Stickleback	*Culaea*	*inconstans*	2
North Creek	18-Sep-09	N52.38472	W101.58739	E	194 sec	White Sucker	*Catostomus*	*commersonii*	1
Lagoon Creek	12-Jul-09	N52.33763	W101.58140	D	--	Fathead Minnow	*Pimephales*	*promelas*	20
Lagoon Creek	12-Jul-09	N52.33763	W101.58140	D	--	Common Shiner	*Luxilus*	*cornutus*	1
Lagoon Creek	12-Jul-09	N52.34027	W101.57434	D	--	Fathead Minnow	*Pimephales*	*promelas*	7
Lagoon Creek	12-Jul-09	N52.34027	W101.57434	D	--	Common Shiner	*Luxilus*	*cornutus*	2
Lagoon Creek	12-Jul-09	N52.33849	W101.58044	S	--	Common Shiner	*Luxilus*	*cornutus*	44
Lagoon Creek	12-Jul-09	N52.33849	W101.58044	S	--	Fathead Minnow	*Pimephales*	*promelas*	11
Lagoon Creek	12-Jul-09	N52.33849	W101.58044	S	--	Finescale Dace	*Phoxinus*	*neogaeus*	1
Lagoon Creek	12-Jul-09	N52.34055	W101.57718	S	--	Western Blacknose Dace	*Rhinichthys*	*obtusus*	1
Lagoon Creek	12-Jul-09	N52.34055	W101.57718	D	--	Western Blacknose Dace	*Rhinichthys*	*obtusus*	6
Lagoon Creek	12-Jul-09	N52.34055	W101.57718	D	--	Finescale Dace	*Phoxinus*	*neogaeus*	1
Lagoon Creek	12-Jul-09	N52.34055	W101.57718	D	--	Brook Stickleback	*Culaea*	*inconstans*	2
Lagoon Creek	12-Jul-09	N52.34055	W101.57718	D	--	Johnny Darter	*Etheostoma*	*nigrum*	2
Lagoon Creek	12-Jul-09	N52.33891	W101.57933	S	--	Fathead Minnow	*Pimephales*	*promelas*	13
Lagoon Creek	12-Jul-09	N52.33891	W101.57933	S	--	Common Shiner	*Luxilus*	*cornutus*	52
Lagoon Creek	12-Jul-09	N52.33891	W101.57933	S	--	Finescale Dace	*Phoxinus*	*neogaeus*	1
Lagoon Creek	14-Jul-09	N52.33840	W101.57946	D	--	Common Shiner	*Luxilus*	*cornutus*	12
Lagoon Creek	14-Jul-09	N52.33840	W101.57946	D	--	Brook Stickleback	*Culaea*	*inconstans*	1
Lagoon Creek	14-Jul-09	N52.33840	W101.57946	D	--	Fathead Minnow	*Pimephales*	*promelas*	6
Lagoon Creek	14-Jul-09	N52.33840	W101.57946	D	--	Johnny Darter	*Etheostoma*	*nigrum*	2
Lagoon Creek	14-Jul-09	N52.34048	W101.57560	S	--	Common Shiner	*Luxilus*	*cornutus*	18
Lagoon Creek	14-Jul-09	N52.34048	W101.57560	S	--	Fathead Minnow	*Pimephales*	*promelas*	9

Appendix C. continued…

Creek	Date	Latitude	Longitude	Methods	Effort	Common Name	Genus	Species	Numbers Captured
Lagoon Creek	12-Jul-09	N52.33710	W101.58507	M	24 hours	--	--	--	--
Lagoon Creek	12-Jul-09	N52.33694	W101.58339	M	24 hours	--	--	--	--
Lagoon Creek	12-Jul-09	N52.33734	W101.58198	M	24 hours	--	--	--	--
Lagoon Creek	12-Jul-09	N52.33794	W101.58088	M	24 hours	--	--	--	--
Lagoon Creek	12-Jul-09	N52.33823	W101.58049	M	24 hours	--	--	--	--
Lagoon Creek	13-Jul-09	N52.33840	W101.57946	M	24 hours	--	--	--	--
Lagoon Creek	13-Jul-09	N52.33891	W101.57933	M	24 hours	--	--	--	--
Lagoon Creek	13-Jul-09	N52.33979	W101.57749	M	24 hours	--	--	--	--
Lagoon Creek	13-Jul-09	N52.34006	W101.57727	M	24 hours	--	--	--	--
Lagoon Creek	13-Jul-09	N52.34055	W101.57718	M	24 hours	--	--	--	--

Appendix D. Modified Creel Survey, Barrel Counts for Walleye and Northern Pike on Whitefish Lake 1999 – 2008**.**





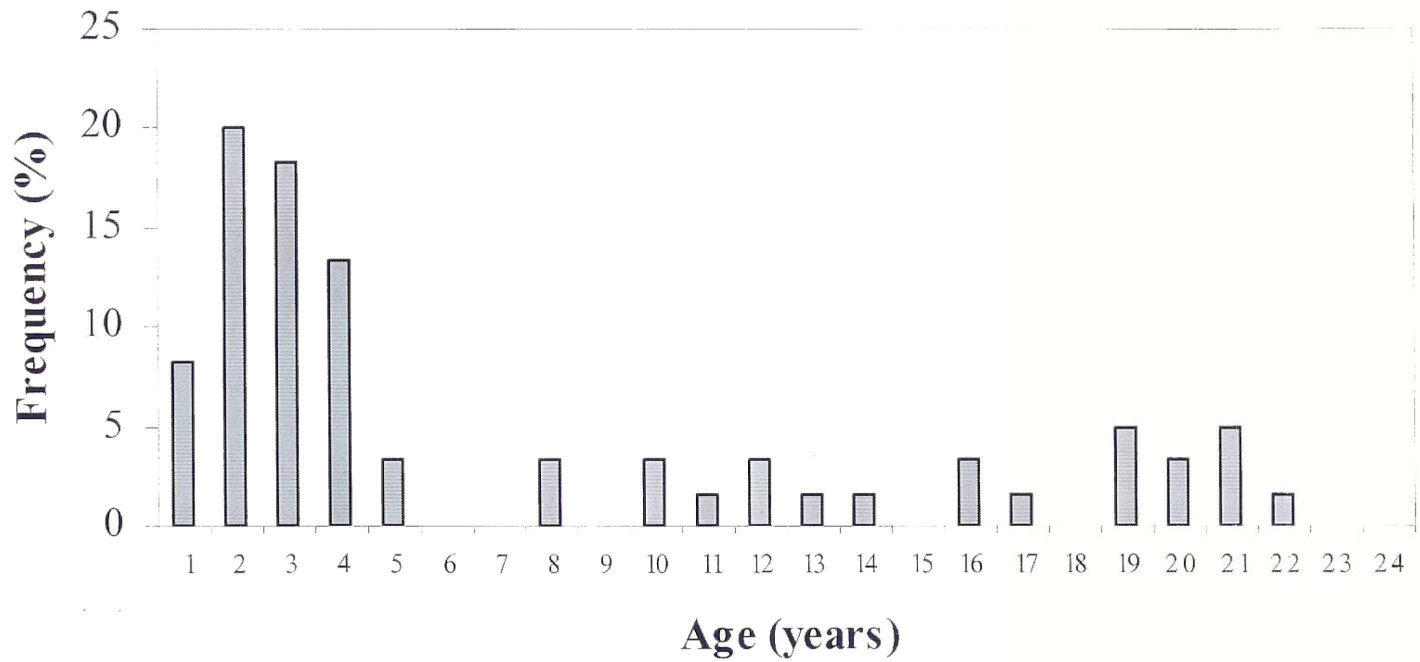
Appendix E. INDEX NETTING WHITEFISH LAKE FOR WALLEYE 1996 to 2001

TABLE 1

TOTAL CATCH BY GANG LOCATION
WHITEFISH LAKE - 1996

SPECIES	GANG NUMBER						TOTALS
	1	2	3	4	5	6	
Walleye	14	40	11	6	8	27	106
Northern Pike	1	18	9	3	-	13	44
Whitefish	-	1	25	76	28	1	131
Cisco	1	2	8	58	165	1	235
Yellow Perch	1	5	1	-	-	7	14
White Sucker	23	31	28	13	26	36	157
Totals	40	97	82	156	227	85	687

Figure 1.
Age Frequencies - Whitefish Lake, 2001
Walleye (n=60)



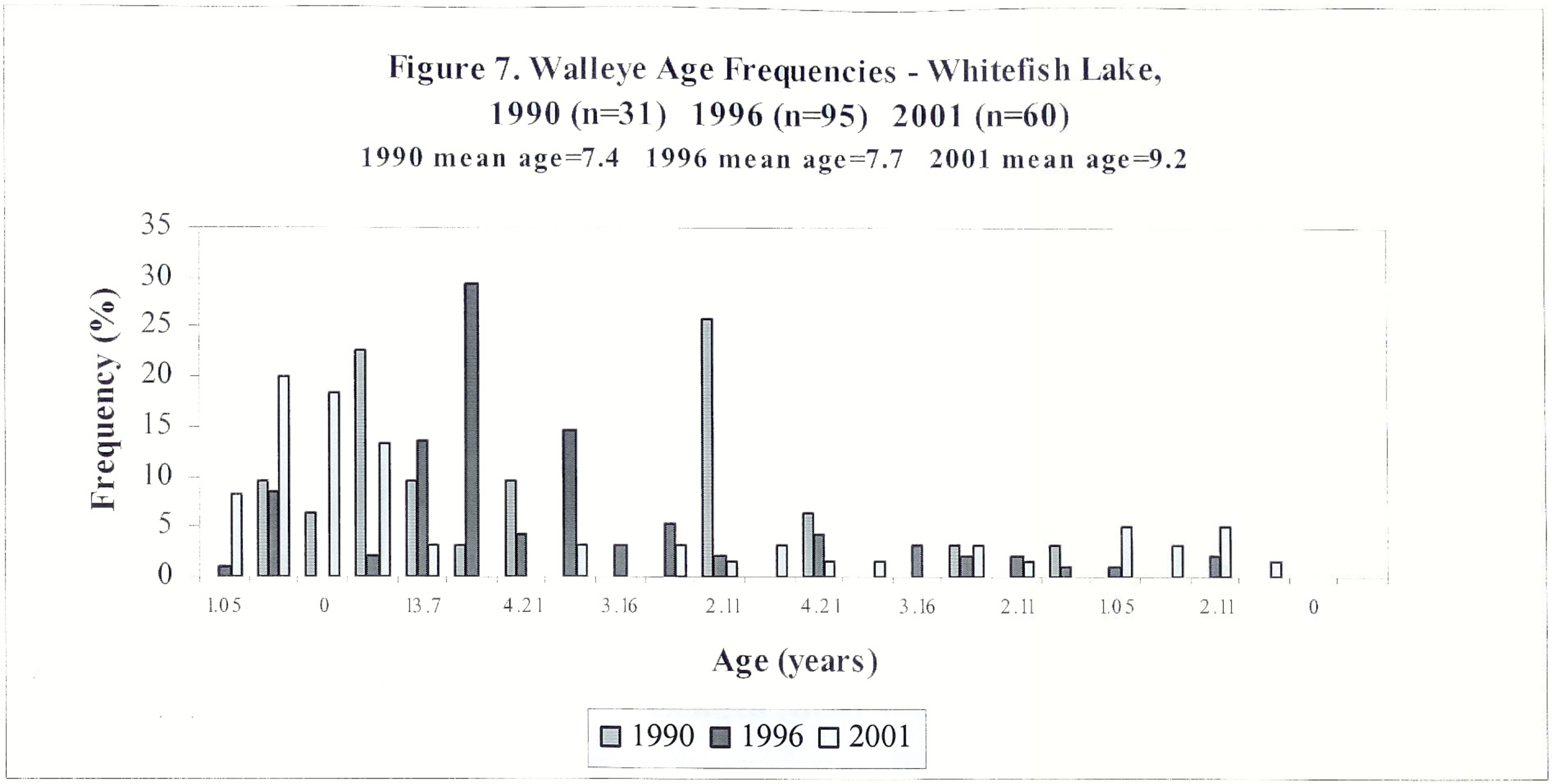
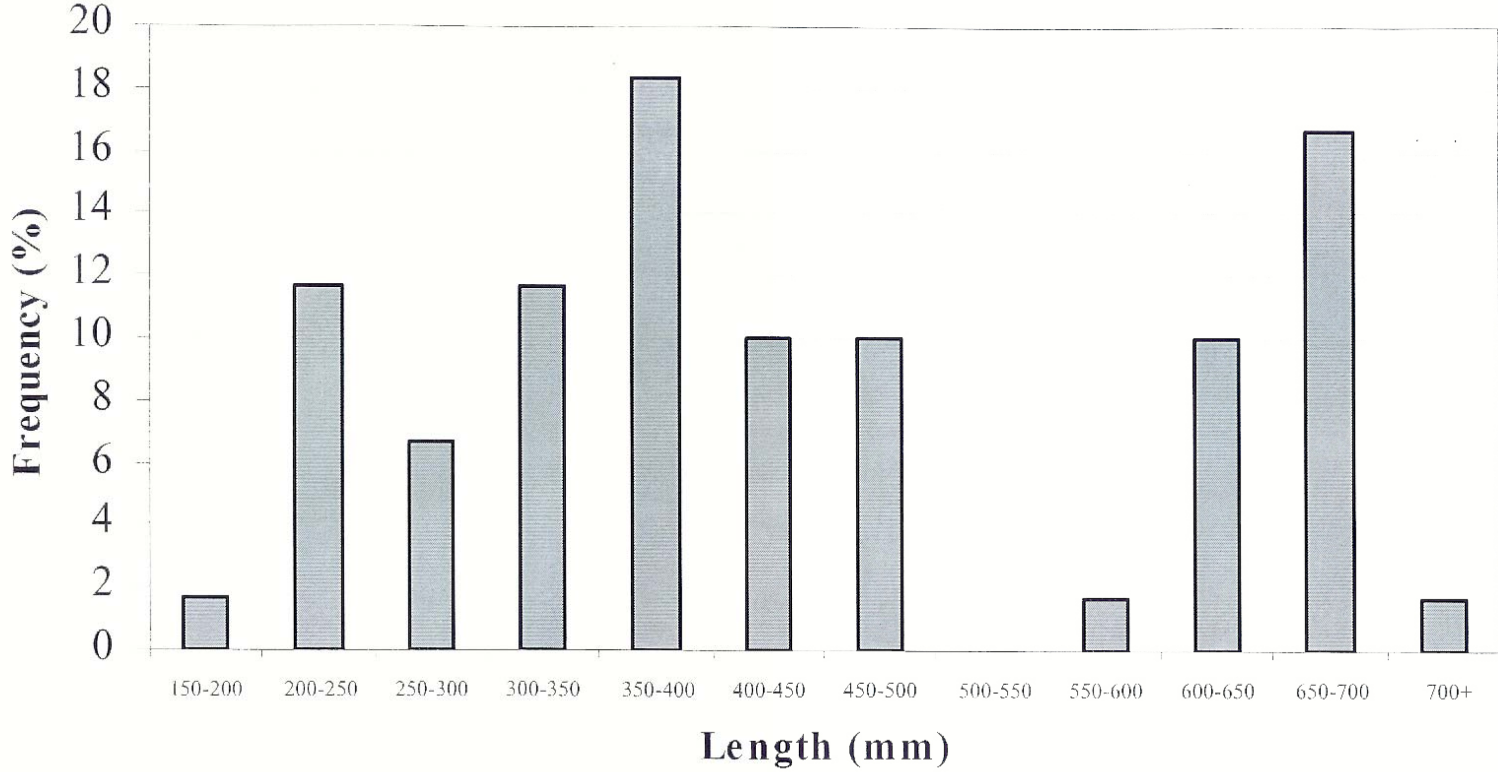


Figure 7. Walleye Age Frequencies - Whitefish Lake,
1990 (n=31) 1996 (n=95) 2001 (n=60)
1990 mean age=7.4 1996 mean age=7.7 2001 mean age=9.2
Frequency (%)
35
30
25
20
15
10
5
0
1.05
0
13.7
4.21
3.16
2.11
4.21
3.16
2.11
1.05
2.11
0
Age (years)
1990
1996
2001

Figure 4.
Walleye Length Frequencies - Whitefish Lake, 2001
n=60
Note: Slot size = 45-70 cm



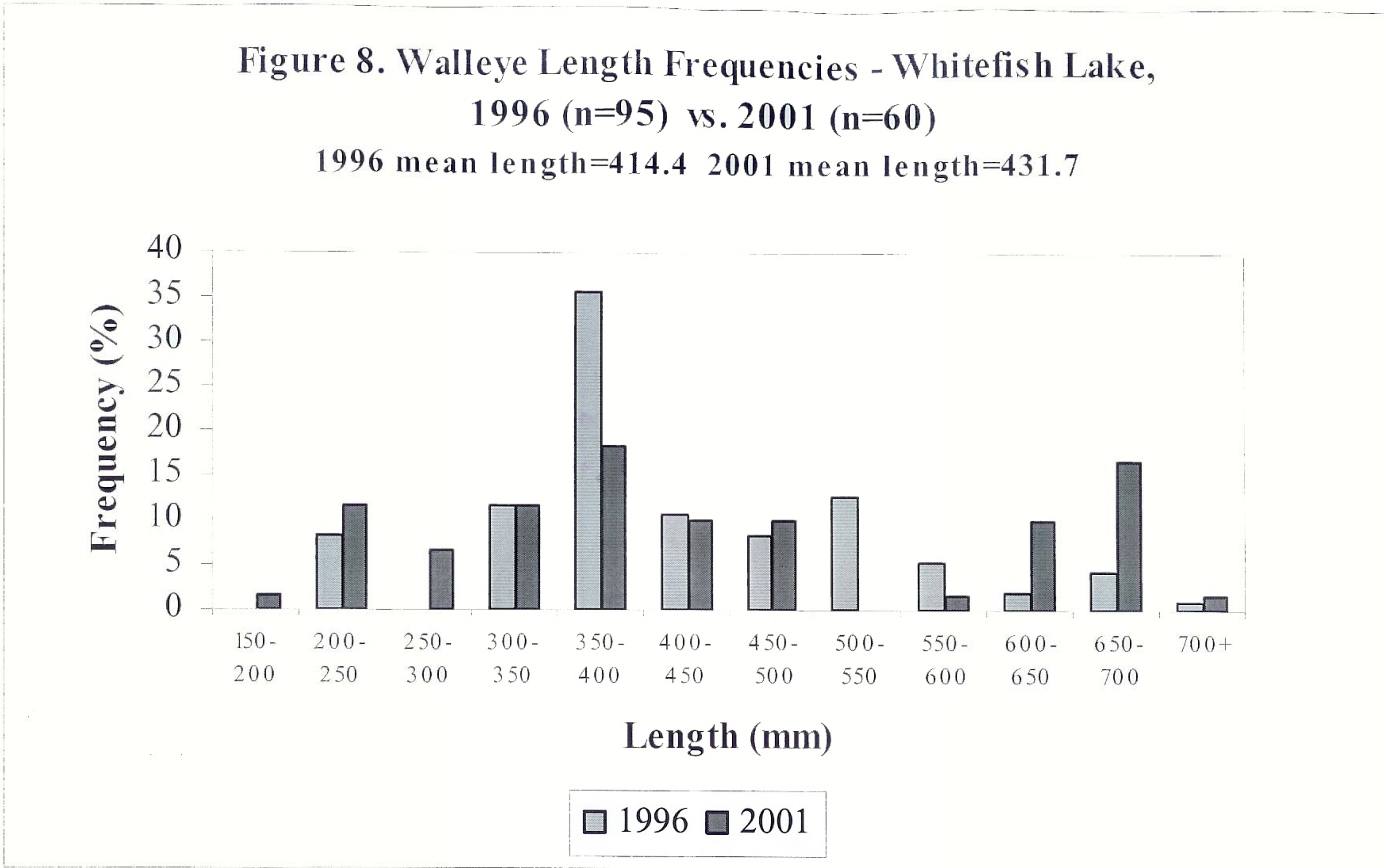


Figure 8. Walleye Length Frequencies - Whitefish Lake,
1996 (n=95) vs. 2001 (n=60)
1996 mean length=414.4 2001 mean length=431.7
Frequency (%)
40
35
30
25
20
15
10
5
0
150-200
200-250
250-300
300-350
350-400
400-450
450-500
500-550
550-600
600-650
650-700
700+
Length (mm)
1996
2001

-